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The Operating Organization for Nuclear Power Plants

SAFETY GUIDE

No. NS-G-2.4



INTERNATIONAL
ATOMIC ENERGY AGENCY
VIENNA

THE OPERATING ORGANIZATION FOR
NUCLEAR POWER PLANTS

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The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

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FOREWORD

By Yukiya Amano
Director General

One of the statutory functions of the IAEA is to establish or adopt standards of safety for the protection of health, life and property in the development and application of nuclear energy for peaceful purposes, and to provide for the application of these standards to its own operations as well as to assisted operations and, at the request of the parties, to operations under any bilateral or multilateral arrangement, or, at the request of a State, to any of that State's activities in the field of nuclear energy.

The following bodies oversee the development of safety standards: the Commission for Safety Standards (CSS); the Nuclear Safety Standards Committee (NUSSC); the Radiation Safety Standards Committee (RASSC); the Transport Safety Standards Committee (TRANSSC); and the Waste Safety Standards Committee (WASSC). Member States are widely represented on these committees.

In order to ensure the broadest international consensus, safety standards are also submitted to all Member States for comment before approval by the IAEA Board of Governors (for Safety Fundamentals and Safety Requirements) or, on behalf of the Director General, by the Publications Committee (for Safety Guides).

The IAEA's safety standards are not legally binding on Member States but may be adopted by them, at their own discretion, for use in national regulations in respect of their own activities. The standards are binding on the IAEA in relation to its own operations and on States in relation to operations assisted by the IAEA. Any State wishing to enter into an agreement with the IAEA for its assistance in connection with the siting, design, construction, commissioning, operation or decommissioning of a nuclear facility or any other activities will be required to follow those parts of the safety standards that pertain to the activities to be covered by the agreement. However, it should be recalled that the final decisions and legal responsibilities in any licensing procedures rest with the States.

Although the safety standards establish an essential basis for safety, the incorporation of more detailed requirements, in accordance with national practice, may also be necessary. Moreover, there will generally be special aspects that need to be assessed on a case by case basis.

The physical protection of fissile and radioactive materials and of nuclear power plants as a whole is mentioned where appropriate but is not treated in detail; obligations of States in this respect should be addressed on the basis of the relevant instruments and publications developed under the auspices of the IAEA. Non-radiological aspects of industrial safety and environmental protection are not explicitly considered; it is recognized that States should fulfil their international

undertakings and obligations in relation to these.

The requirements and recommendations set forth in the IAEA safety standards might not be fully satisfied by some facilities built to earlier standards. Decisions on the way in which the safety standards are applied to such facilities will be taken by individual States.

The attention of States is drawn to the fact that the safety standards of the IAEA, while not legally binding, are developed with the aim of ensuring that the peaceful uses of nuclear energy and of radioactive materials are undertaken in a manner that enables States to meet their obligations under generally accepted principles of international law and rules such as those relating to environmental protection. According to one such general principle, the territory of a State must not be used in such a way as to cause damage in another State. States thus have an obligation of diligence and standard of care.

Civil nuclear activities conducted within the jurisdiction of States are, as any other activities, subject to obligations to which States may subscribe under international conventions, in addition to generally accepted principles of international law. States are expected to adopt within their national legal systems such legislation (including regulations) and other standards and measures as may be necessary to fulfil all of their international obligations effectively.

EDITORIAL NOTE

An appendix, when included, is considered to form an integral part of the standard and to have the same status as the main text. Annexes, footnotes and bibliographies, if included, are used to provide additional information or practical examples that might be helpful to the user.

The safety standards use the form 'shall' in making statements about requirements, responsibilities and obligations. Use of the form 'should' denotes recommendations of a desired option.

The English version of the text is the authoritative version.

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1. INTRODUCTION

BACKGROUND

1.1. This Safety Guide was prepared under the IAEA programme for establishing safety standards for nuclear power plants. This publication is a revision of the IAEA Safety Guide on Operating Organization for Nuclear Power Plants issued in 2001 as IAEA Safety Standards Series No. NS-G-2.4. It provides recommendations on fulfilling the requirements established in Sections 3, 4 and 5 of Safety of Nuclear Power Plants: Commissioning and Operation, Safety Standards Series No. SSR-2/2 (Rev. 1) [1] and in Sections 4 and 6 of Leadership and Management for Safety, IAEA Safety Standards Series No. GSR Part 2 [8].

1.2. Nuclear power technology is different from the customary technology of power generation from fossil fuel and by hydroelectric means. One major difference between the management of nuclear power plants and that of conventional generating plants is the emphasis that should be placed on nuclear safety, ~~management system~~—the management of radioactive waste and radiological protection, and the accompanying national regulatory requirements. This Safety Guide highlights the important elements of effective management—~~system~~—in relation to these aspects of safety.

1.3. The attention to be paid to safety requires that the management recognizes that personnel involved in the nuclear power programme should understand, respond effectively to, and continuously search for ways to enhance safety in the light of any additional requirements socially and legally demanded of nuclear energy. This will help to ensure that a safety policy that result in the safe operation of nuclear power plants is implemented and that margins of safety are always maintained. The structure of the organization, management system and administrative controls should be such that there is a high degree of assurance that the safety policy and decisions are implemented, safety is continuously enhanced and a strong safety culture is promoted and supported.

OBJECTIVE

1.4. The objective of this publication is to guide Member States in setting up an operating organization which facilitates the safe operation of nuclear power plants to a high level internationally. The second objective is to provide guidance on the most important organizational elements in order to contribute to a strong safety culture and achieve good performance in terms of safety.

SCOPE

1.5. This publication identifies the main safety objectives and responsibilities of management with respect to the safe operation of nuclear power plants and associated corporate roles of the operating organization.

1.6. This Safety Guide discusses the factors to be considered in (a) structuring the operating organization to meet these main safety objectives, (b) setting up a management system that ensure that the safety tasks are performed, (c) establishing programmes that are intended to meet the above requirements and (d) maintaining a strong safety culture within the organization.

1.7. This Safety Guide primarily addresses safety matters directly related to the operation of nuclear power plants. It assumes that the safety aspects of siting, design, manufacturing and construction have been resolved. It also covers the internal interrelationships between operations and design, construction and commissioning and other organizational units, and deals with the involvement of the operating organization in reviews of safety issues, bearing in mind future operation. Finally, this publication discusses the relationship between the operating organization, the regulatory body and the general public.

STRUCTURE

1.8. Section 2 focuses on the operating organization and its structure. Section 3 discusses the functions, responsibilities, goals and objectives of the operating organization that ensure the safe operation of nuclear power plants. Section 4 gives provides guidance on the interface between the operating organization and external organizations. Section 5 covers aspects of management for safety. Section 6 provides guidance on the major management programmes that should be established to ensure the safe operation of a nuclear power plant. ~~Section 7 discusses additional services that are needed to support the functioning of plant operation management programmes. Section 8–Section 7~~ provides general guidance on the communication and liaison matters that are relevant to meeting management objectives and discharging responsibilities.

2. ORGANIZATIONAL STRUCTURE

THE OPERATING ORGANIZATION

2.1. For the purpose of this Safety Guide, the term ‘operating organization’ is used to designate the company or utility that is authorized to operate one or more nuclear power plants Ref.[31]. In accordance with the legal systems in the majority of Member States, an operating organization is the legal entity responsible for fulfilling

the nuclear safety, financial and commercial obligations and any other obligations which may arise in connection with the operation of the nuclear power plants. Irrespective of the operating organization's other obligations and responsibilities, this Safety Guide deals only with those that are necessary to ensure safe operation of the nuclear power plants that are under the control of the operating organization.

2.2. Once the operating organization accepts control over a plant, it is completely in charge of the plant, with full responsibility and commensurate authority for approved activities in the safe production of electric power. Since these activities affect safety, the operating organization, in accordance with its licensing obligations, shall establish a policy for adherence to safety requirements and procedures for safe control of the plant under all conditions, including maintenance and surveillance, and shall retain a competent, fit and fully trained staff as stated in Ref.[1],[CR2]

2.3. The operating organization is authorized to operate a nuclear power plant through the licensing system in accordance with the national regulations. More information on the matters of authorization and licensing of operating organizations can be found in Ref. Governmental, Legal and Regulatory Framework for Safety, Safety Standards Series No. GSR Part 1 (Rev. 1) [2]. Ref.[1] states that the operating organization, as licensee, shall retain prime responsibility for safety, but it may delegate authority for the safe operation of the plant to the plant management. In such cases the operating organization shall provide the necessary resources and support to the plant management. The management of the plant shall ensure that the plant is operated in a safe manner and in accordance with all legal and regulatory requirements Ref.[2]. The achievement of this primary objective should be regularly reviewed by the operating organization.[CR3]

ORGANIZATIONAL PLAN

2.4. The operating organization which operates or intends to operate one or more nuclear power plants should establish an organizational structure to meet the general requirements for the safe operation of these plants, taking into consideration any particular situation or conditions involved.

2.5. The operating organization should examine the various functions that are needed for safe operation of a nuclear power plant; it should decide which functions should be performed (a) at the plant site, (b) off the site but within the operating organization, or (c) outside the operating organization.

2.6. In addition, the complexity of the planned nuclear power plant, its engineering features, the number of nuclear and other plants already in operation, under construction or planned for construction, and the general structure of the operating

organization itself should be considered.

2.7. On the basis of these considerations and of all applicable regulatory requirements and national industrial practices, the operating organization should establish for plants under its control an organizational plan that indicates the general policies, lines of responsibility and authority, lines of communication, duties, and numbers of staff needed to run the plants and their required qualifications. The operating organization should take into account both operational states and accident conditions. The organizational plan should be regularly reassessed and, if necessary, updated to reflect developments in safe operation.

2.8. The organizational plan should be established well in advance so that the required structure (including recruitment and training of personnel) is operational as required for the commissioning phase and, in all cases, before commencement of operation. It should form the basis for the first recruitment and training programme as well as for all such subsequent programmes.

STRUCTURE OF THE OPERATING ORGANIZATION

2.9. Although an operating organization may already have an organizational structure for managing non-nuclear generating plants before the advent of a nuclear power plant, the emphasis on the safety of the plant and the commitment to achieve safety will require more than a simple augmentation of the earlier organizational structure. The factors to be considered in determining the structure of the operating organization and its staffing requirements for a nuclear power programme should include, but are not limited to, the following:

- (1) the need to ensure that structures, systems and components important to safety remain in accordance with the design assumptions and intent;
- (2) the need for radiation protection and related medical provisions;
- (3) the need to ensure that systems and components are available to cool the fuel and contain the radioactive material during all operational states; and accident conditions. ~~design-basis accidents and design-extension conditions including core melting~~ [CR4] ;
- (4) the need to ensure control of reactivity and to prevent inadvertent criticality;
- (5) the necessity for design, construction, operation and modifications to be thoroughly analysed and reviewed with the aim of ensuring safety;
- (6) the need to be prepared for emergency situations, and to co-ordinate emergency plans with those of the regulatory body, public authorities and other organizations which may be required to take action;
- (7) the need to minimize and control radioactive releases and provide for environmental surveillance;
- (8) the need to control access to the plant and to certain areas within the site in

- order to ensure radiological safety and to protect individuals and the plant against actions that would jeopardize safety;
- (9) the need to conduct activities affecting items important to safety in accordance with management system requirements, including the need to verify whether such activities have been performed as specified;
 - (10) the need for emphasis on training and retraining of personnel and contractors to achieve and maintain an adequate level of competence, and to inculcate the necessary attitude towards safety;
 - (11) the need to consider all organizational factors that can affect human performance, so that work can be carried out safely and satisfactorily without imposing unnecessary physical and psychological stress on plant personnel;
 - (12) the need to ensure that attitude towards safety is one of the selection criteria for recruiting staff, appraising staff performance and promoting managers;
 - (13) the need to know and understand the requirements of the regulatory body, to make proposals to meet these requirements and to implement them in a timely manner;
 - (14) the need to set up a system of formal corporate communication with the regulatory body;
 - (15) the need for additional services and facilities for activities such as maintenance, fuel management, chemistry control, surveillance, in-service inspection, and monitoring and improving plant performance as well as for modifying and procuring special items;
 - (16) the need for worldwide operational experience to be systematically reviewed and fed back so that appropriate actions can be taken; and
 - (17) the need to ensure an open exchange of information, both upwards and downwards within the organization.

2.10. In addition, an organizational structure should ensure the following:

- That technical services and expertise, including those required for emergency situations, are provided. The extent to which these are provided from inside or outside the organization is a matter of management policy;
- That the personnel involved in the review of safety related activities are independent from cost and schedule considerations.

2.11. The document describing the plant's organizational structure should indicate the staffing arrangements within the categories of direct line operating personnel and supporting personnel. Clear lines of authority should be established to deal with matters bearing on plant safety. The extent to which the support functions are self-sufficient or dependent upon services from outside the plant organization should be demonstrated by means of functional organizational charts which include personnel resource allocations and specify the duties and responsibilities of key personnel.

2.12. The description of the structure and of the functions to be performed by the individual departments in the operating organization, on and off the site, and by the individual persons in each department, as well as the lines of responsibility, authority and communication, should be unambiguous and should leave no scope for improvisation in either operational states or accident conditions. This description should be a part of the management system. Functions to be performed by external organizations or consultants should also be indicated in the description, together with the related lines of communication and authority.

2.13. The response time for obtaining services from off-site sources should be taken into account in determining the structure of the organization. In that case[CR5], the on-site organization should be capable of rendering all necessary services.

2.14. Position descriptions or equivalent procedural guidance should be used to supplement the organizational chart. Position descriptions should clearly define the authorities, responsibilities and competences for each position or position category within the operating organization as a whole, and within the plant, department and functional group.

2.15. The description of the responsibilities and competences needed for each position should form the basis for the definition of the required qualifications and of the prerequisites for recruiting, training and continuing training of the individual persons.

2.16. Changes to staffing levels, ways of working or organizational structure should be subject to analysis and independent review when proposed. Changes should be monitored during and after implementation to ensure that they are not detrimental to safety.

2.17. For significant organizational changes, an implementation plan should be drawn up to scrutinize their effects on safety in order to ensure that any changes in the organizational structure are properly considered in terms of safety before being implemented. For such changes, independent internal review may also be required. For more guidance on organizational changes, see Ref. Modifications to Nuclear Power Plants, Safety Standards Series No. NS-G-2.3 [3].

2.18. When there are several operating organizations within one country, these operating organizations should establish special arrangements for an effective exchange of experience, services and facilities.

2.19. In developing its structure, the operating organization may be influenced by the

character (centralized, federalized or regionalized) of the national and local authorities, including the regulatory body. Regardless of the organizational structure adopted, consideration should be given to the implementation of the plant operation management programmes covered in Section 6.

3. FUNCTIONS AND RESPONSIBILITIES

FUNCTIONS OF THE OPERATING ORGANIZATION

3.1. In establishing the structure of the operating organization, consideration should be given to the management functions in the following areas Ref.[1]:

- Policy making functions, which include: setting management objectives; establishing a policy for nuclear safety and for quality; allocating resources; providing material and human resources; approving the contents of management programmes; setting policies on fitness for duty; and establishing a programme to make the necessary changes to any of these functions on the basis of the performance in achieving objectives;
- Operating functions, which include executive decision making and actions for the operation of a plant, both in operational states and in accident conditions;
- Supporting functions, which include obtaining from both on-site and off-site organizations the technical and administrative services and facilities necessary to perform the operating functions;
- Reviewing functions, which include critical monitoring of the performance of the operating and supporting functions, and review of the design. The purpose of monitoring is to verify compliance with the stipulated objectives for safe operation of the plant, to reveal deviations, deficiencies and equipment failures, and to provide information for the purpose of taking timely corrective action and making improvements. Reviewing functions should also include review of the overall safety performance of the organization in order to assess the effectiveness of management for safety and to identify opportunities for improvement.

RESPONSIBILITIES OF THE OPERATING ORGANIZATION

3.2. The operating organization management should have the following main responsibilities:

- (1) Ensuring safe operation of its plants by implementing an adequate organizational structure, allocating responsibilities and delegating authority within the organization with a view to achieving proper management and minimizing interface problems;

- (2) Establishing a safety policy and implementing management programmes for safe operation (see Section 6), and verifying their effectiveness;
- (3) Establishing and implementing an appropriate policy on an individual's suitability for duty, addressing adequate physical and mental fitness and aspects such as the illicit use of drugs or tobacco and alcohol abuse, in consonance with national regulations. This policy should be addressed to all employees, contractors and visitors, as applicable;
- (4) Establishing liaison with public authorities and the regulatory body for the purposes of considering, understanding and ensuring compliance with regulatory requirements;
- (5) Establishing liaison with design, construction, commissioning, manufacturing and other organizations involved with the nuclear power plant or plants, to ensure proper transfer and understanding of the plant design intent and assumptions, information and experience;
- (6) Providing resources, services and facilities to plant management;
- (7) Providing adequate information for the purposes of liaison and public relations;
- (8) Ensuring the collection, evaluation, implementation and dissemination of operational experience;
- (9) Ensuring that the decision making process gives adequate consideration to the selection of priorities and the organization of activities;
- (10) Establishing arrangements and assigning responsibilities for accident management;
- (9)(11) Establishing arrangements and assigning responsibilities for on-site emergency ~~planning~~ preparedness [CR6][CR7][CR8] and response.

All these responsibilities should be documented.

3.3. The prime responsibility for the safety of nuclear power plants rests with the operating organization Ref.[1]. It is responsible for specifying safety criteria and assuring itself that the design, construction and operation of nuclear power plants meet the applicable safety criteria. In addition, it is responsible for the establishment of procedures and arrangements to ensure the safe control of nuclear power plants under all conditions, for the establishment and maintenance of a competent and motivated staff and for the control of the fissile and radioactive materials utilized or generated. These responsibilities should be discharged in accordance with applicable safety objectives and management system.

3.4. Management of the operating organization should ensure that its organization is well structured, with clear lines of authority and communication and well-defined responsibilities, and that its safety policy is established, understood and observed by all involved. However, the assignment of tasks among organizations should not reduce or divide the prime responsibility for safety, which lies with the management

of the operating organization. As a result, the operating organization remains in a supervisory position for delegated tasks.

3.5. To ensure that there is a clear understanding of responsibilities and relationships between organizational units and between personnel within the operating organization, detailed job specifications should be defined. In particular, these relationships should be clearly defined for all activities having a direct or indirect bearing on safety.

3.6. The operating organization should establish high performance standards for all activities relating to safe operation of a plant, and should effectively communicate these standards throughout the organization. All levels of management should promote and require consistent adherence to these high standards. Management of the operating organization should foster a working environment that encourages the achievement of high standards in safe operation of the plant.

3.7. The operating organization should be responsible for providing all equipment, staff, procedures, training and management practices necessary for safe operation, including the fostering of an environment in which safety is seen as a vital factor and a matter of personal accountability for all staff. Reliability in the long term should not be served by compromising safety in the short term.

3.8. The operating organization often delegates operating authority to the on-site management of the nuclear power plant which has direct day to day control. Accordingly, the operating organization should [CR9] have a responsibility to monitor the effectiveness of management for safety at the nuclear power plant and to take necessary measures to ensure that safety is continuously improved or at least maintained at the level established by design.

3.9. Within the operating organization, powers of authority that are delegated should be specified at the appropriate levels of management system.

RESPONSIBILITIES OF THE PLANT MANAGEMENT

3.10. The responsibilities of the plant managers encompass: implementation of the safety policy of the operating organization, establishment and perpetuation of a strong safety culture, and control and verification of safety related activities.

3.11. The chief executive member of the operating organization on the site is the plant manager (sometimes called the station superintendent). The plant manager is the representative of the licensee on the site and has the overall responsibility for safe and reliable operation of the plant. In discharging this responsibility the plant manager may, depending on the structure of the operating organization, also be responsible for overall co-ordination of technical support functions, whether performed by site

personnel or by personnel from off-site departments or external organizations. The plant manager is therefore responsible for the qualification (including adequate initial and continuing training) of the operating personnel.

3.12. The plant manager ~~should be~~ should be ~~[CR10]~~ responsible for ensuring that the relevant requirements of both the operating organization and the regulatory body are complied with, and, in addition, should be ~~[CR11]~~ involved in public information activities and in maintaining relationships with local authorities.

3.13. If services are provided outside the direct control of the plant manager, then functional relationships should be defined to clarify the responsibilities of the two parties. It is the usual practice for the plant manager, as the senior on-site member of the operating organization, to be designated as representative of the operating organization and to be accountable for ensuring that the second party (who is providing the service) meets the operating organization's objectives and statutory requirements, including those established by the regulatory body.

3.14. In cases where functions are wholly or partly unamenable to direct control, the plant manager should be still responsible for promoting in a documented manner the satisfactory execution of plant related actions stemming from these functions.

3.15. To improve human performance, senior managers in each organization should understand and support the need to develop the leadership, management and technical skills of all individuals involved in plant activities to the extent necessary to perform their assigned tasks. This support should be in the form of modelling the new behaviours and providing resources including adequate funds to develop and implement leadership, management and technical skills programmes.

3.16. This is part of a manager's role in setting the standards and expectations for all staff in all aspects of safe management of a plant. In addition, managers themselves should visibly meet these standards and should help staff to understand why they are appropriate.

3.16.A The managers should be regularly in the field to assess and discuss conduct of work and compliance with management expectations and objectives.

~~3.16.~~ 3.17. In assigning responsibilities and accountabilities for safety, managers should ensure that the individuals concerned have the capability and the appropriate resources to carry out these safety responsibilities effectively. They should also ensure that their staff are aware of and accept their safety responsibilities. Staff should also be aware of how their responsibilities relate to others in the organization.

~~3.17.~~3.18. Line managers should be responsible for the safety of all operations under their control. The structure of the organization thus needs to reflect this accountability of line management for safety. However, the exact [CR12] management structure will also need to reflect the specific requirements of the organization. The roles, responsibilities and authorities of managers and management units within the organization should be clearly specified and should be compatible with each other.

3.18.A A review of the organization and management system should be periodically performed to confirm that the policies and objectives are implemented in a safe, efficient and effective manner and the processes are adequate to ensure the safe operation of the plant. More information can be found in Refs.[1] and [8].

GOALS AND OBJECTIVES

~~3.18.~~3.19. Since the operating organization has overall responsibility for the safe operation of its nuclear power plants, its management objectives should be to ensure that:

- the approved design enables the plant to be operated safely;
- the plant is constructed in accordance with the design;
- the plant is tested, pursuant to prescribed specifications, to demonstrate that design and construction requirements have been met and that the plant can be operated in accordance with the operational limits and conditions, and design assumptions and intent;
- the plant is operated and maintained in accordance with the operational limits and conditions, authorized procedures and design assumptions and intent, by a sufficient number of competent persons who are adequately trained to cope with abnormal situations, including emergency situations;
- adequate facilities and services are available in a timely manner during normal operation and for responding to all kinds of anticipated operational occurrences, design basis accidents and postulated severe accidents;
- for all levels of requirements, the arrangements with participating organizations are adequate and effective;
- adequate arrangements for response to all kinds of anticipated operational occurrences and accident conditions have been made and appropriate actions have been taken to provide for protection of the health and safety of the site personnel and the public, and for protection of the environment.

~~3.19.~~3.20. The plant management should develop goals and objectives that support and complement established corporate goals. The plant goals and objectives should be commensurate with the expectations of the management of the operating organization, and should include key performance areas of the plant and

areas recognized as needing improvement. Suitable goals and objectives should be established at the departmental level to support the goals of the plant management. Departmental goals and objectives should be coordinated among the departments to ensure that they are consistent and mutually supportive and reflect management's priorities.

~~3.20.3.21.~~ Where it is reasonable, the goals and objectives of all management levels should be measurable and stated in terms that allow measurement of progress and clear determination of achievement. They should be challenging, realistic and focused on specific improvements in performance, and should be limited in number to prevent dilution of efforts in key areas. They should be communicated, understood and supported within the organizational structure responsible for their accomplishment.

3.22. Management, at the appropriate level, should periodically review progress towards the accomplishment of goals and objectives. Formal reviews of progress should be conducted and results should be communicated periodically to the personnel of the operating organization.

~~3.21.~~

~~3.22.3.23.~~ The performance objectives and targets of each department should be known and understood by its staff, who should also know the current position with respect to their achievement.

~~3.23.3.24.~~ Personnel should be held accountable for the achievement of goals and objectives assigned to them and should be recognized for the achievement of goals and objectives and for actions performed to this end.

4. INTERFACES WITH EXTERNAL ORGANIZATIONS

INTERFACE WITH THE REGULATORY BODY

4.1. The operational safety of a nuclear power plant is subject to surveillance by a regulatory body that is independent of the operating organization. For the achievement of their common objective — safe operation — there should be mutual understanding and respect between the regulatory body and the operating organization to support a frank, open and yet formal relationship. Further information on the role of the regulatory body can be found in Ref.[2].

4.2. The operating organization should submit or make available documents and other information in accordance with the regulations and requirements of the regulatory body.

4.3. The operating organization should give the regulatory body access to the plant, and, when necessary, undertake special analyses, tests and inspections to meet the regulatory requests. If any request is made to the operating organization which in its opinion could have an adverse effect on safety, then, in view of its responsibility for safety, the operating organization should [CR13]make its opinion known to the regulatory body[CR14].

4.4. The operating organization should develop and implement a procedure for reporting incidents and abnormal events of significance to safety to the regulatory body in accordance with established criteria. The operating organization should establish programmes to analyse operating experience so as to ensure that lessons are learned and acted upon. Such experience

should be shared with relevant national and international bodies (see also paragraphs 6.62–6.71). [CR15]

INTERFACE WITH EXTERNAL SUPPORTING ORGANIZATIONS

4.5. Contractor personnel may be used to perform tasks that are of a specialized or temporary nature for which it is not feasible to hire or maintain a full-time plant employee. When contractor personnel are used, their duties and authorities should be clearly defined. Contractor personnel should be trained and qualified for the task to be performed and held to the same performance standards as plant personnel performing similar tasks.

4.6. The operating organization should ensure that contractor and temporary personnel who perform activities on safety related structures, systems and components are qualified to perform their assigned tasks. Documented assurance should be obtained that contractor personnel have the required qualifications prior to independent involvement in these activities.

4.7. The roles and responsibilities of external supporting organizations (e.g. external maintenance organizations, plant vendors, research institutes and technical support organizations) should be clearly defined and understood. Where these supporting organizations play a significant role in the operation of a plant, the safety management system for the operating organization needs to embrace their activities, while at the same time ensuring that overall control and responsibility for safety rests with the operating organization as licensee.

4.8. The operating organization should contain an adequate number of personnel, with the knowledge, training and skills necessary to supervise and evaluate the work of contractor personnel. Staff of the operating organization required to supervise

contractors or other temporary support staff should be clearly identified.

4.9. Personnel external to the organization who are providing a service or advice, although they may be personally or professionally responsible for the quality of the service or advice given, should have no direct authority over plant personnel unless this is specifically granted. The plant manager's staff should always be responsible for making decisions after taking all aspects into account and after giving careful consideration to any specialist advice provided.

4.10. A wide range of contractual arrangements is possible between the operating organization and suppliers, from individual procurement to a turnkey contract. For procurement, the operating organization faces an extensive task and will need corresponding resources. It should assign knowledgeable and skilled personnel in the pre-operational stages to meet these responsibilities. For turnkey contracts the supplier plays a more wide-ranging role in the construction and testing of the plant. However, as the operating organization retains the responsibility for safe operation of the plant, it should still assign a sufficient number of knowledgeable and skilled personnel during the pre-operational phase. Examples of areas where close co-operation with the supplier is necessary are:

- training of operating staff;
- commissioning of the plant;
- maintenance and in-service inspections;
- technical assistance during operation;
- preparation of normal and emergency operating procedures.

INTERFACE WITH THE PUBLIC

4.11. The operating organization should declare publicly in its policy statement that one of its corporate objectives is its commitment to nuclear safety — this objective overrides the demands of production.

4.12. The public has the right to know the hazard which arises from a nuclear power plant. The operating organization should appropriately disseminate [CR16] such information.

4.13. The operating organization should provide information on the status of the plant to the public in a regular and timely manner. The public should be informed of any significant event on the International Nuclear Event Scale (INES) [4] and of any enforcement action taken by the plant.

4.14. The operating organization should keep the public informed on a regular basis,

even when there is nothing new to report. The public should be provided with information on the measures that would be taken in emergencies.

4.14.A The operating organization should provide clear, objective and understandable information to the public during and after a nuclear or radiological accident, see also Ref. [Preparedness and Response for a Nuclear or Radiological Emergency Series No. GSR Part 7, IAEA, Vienna \(2015\)](#) [20].

5. MANAGEMENT FOR SAFETY

MANAGEMENT FOR SAFETY

5.1. ‘Management for safety’ is the term used for the measures required to ensure that an acceptable level of safety is maintained throughout the lifetime of a nuclear power plant, including decommissioning. The management for safety should [CR17] comprise [CR18] include those arrangements made by the operating organization that are needed to promote a strong safety culture and to achieve and maintain good [CR19] safety performance. It is the management’s responsibility to recognize the safety significance of the organization’s activities.

5.2. It should be clearly understood that management for safety is not separate from or complementary to other business activities of the operating organization. Management for safety should be an integral component of the management of the entire organization; in effect the safety significance of the operating organization’s activities should be understood and recognized and the plant’s safety given the utmost priority overriding, the demands of production and project schedules. [CR20]

5.3. ~~The m~~Management for safety should comprise such organizational elements as: definition of safety policy; identification of the main responsibilities, competences and activities that are needed to ensure safety; arrangements to ensure that the required activities are implemented safely; monitoring of management for safety plans and improvements of safety performance on the basis of lessons learned at the plant concerned and at other plants. In addition, the management for safety should set up the framework that will enable individuals involved in plant activities to carry out their tasks safely and successfully.

5.4. The principles of management for safety should be broadly applied through all organizational structures. Thus, the practices described for the operating organization at the corporate level should be applied, where relevant, to other organizational structures with delegated authority to carry out functions on behalf of the operating organization.

5.5. In order to maintain high effectiveness of management for safety at the plant,

the operating organization should ensure a very high level of commitment to safety. The starting point for management for safety is the involvement of top managers in all organizational structures. The lead in safety matters should come from the highest levels of management. Their safety policy and attitudes should be of the highest standard, and should permeate the operating organization at every level and extend to other organizations performing delegated tasks. There can be no complacency at any level about the continuous attention demanded by safety. Management for safety should imply a learning attitude to safety matters and the open exchange of information both upwards and downwards within the organization. Additional information on the management for safety can be found in Ref.[85].

5.5.A The operating organization should consider the risks associated with low-probability, high-consequence events that could lead to core damage or spread radioactive contamination outside the plant.

SAFETY POLICY

5.5.5.6 Ref.[1] requires that [CR21] a clear safety policy shall be developed by the operating organization and implemented by all site personnel and relevant operating organization personnel. The safety policy should demonstrate the organization's commitment to high safety performance and should be supported by reference to safety standards, the development of targets and provision of the resources necessary to achieve these targets[CR22].

5.7. Ref.[1] requires that this policy shall give plant safety the utmost priority, overriding, if necessary, the demands of production and project schedules. It should require a commitment to excellent performance in all plant activities important to safety and should encourage a questioning attitude and a rigorous and prudent approach to all safety related activities. The formal statement of safety policy should be documented and submitted or made available to the regulatory body and the public[CR23].:-

5.7.A This policy should be based on maintaining the defence in depth during operation of the plant. The independence between the levels of the defence in depth and an adequate reliability of each level should be maintained.

5.7.B To enhance the reliability of each level of defence in depth, the operational activities should be carefully planned, appropriately authorized and carefully carried out by competent staff and in accordance with properly approved procedures, implementing management system practices to achieve a high level of safety performance. In addition, independent safety assessments and verifications should be

carried out for different operational activities, as necessary, to ensure their reliable accomplishment.

5.7.C Conservative decision making should be applied and strong safety culture fostered in all operational activities. Influence of human and organizational factors on one, several or all levels of defence in depth should be especially considered, to avoid negative impact on the reliability of these levels and the independence between the levels.

~~5.6.5.8.~~ To be effective, the safety policy ~~Ref. [11]~~ requires the endorsement and active support of senior managers, who shall also be involved in disseminating the policy throughout the organization. All personnel in the organization shall understand the policy and be aware of their function in ensuring safety, as required by Ref. [1]. [CR24]

~~5.7.5.9.~~ _____ The operating organization should adopt or develop safety standards that specify expectations for the arrangements that are significant to the implementation of the safety policy in different operational areas such as operation, maintenance, technical support, training and qualification. Safety standards and management expectations should be clearly communicated to ensure that they are understood by all those involved in their implementation.

5.10. The operating organization should ensure that adequate resources are available to implement the safety policy. This should include the provision of safe operating plant, the necessary tools and equipment, and a sufficient number of competent staff (supplemented as necessary by consultants or contractors, including plant vendors). In particular, sufficient resources should be ensured to carry out activities in a safe manner, avoiding undue physical or mental stress on individuals.

~~5.8.5.11.~~ _____ The operating organization should demonstrate a commitment to achieving improvements in safety wherever it is reasonably practicable to do so as part of a continuing commitment to the achievement of excellence. The organization's improvement strategy for achieving higher safety performance and for more efficient ways to meet existing standards should be based on a well defined programme with clear objectives and targets against which to monitor progress.

PERFORMANCE OF SAFETY RELATED ACTIVITIES

~~5.9.5.12.~~ _____ Safety related activities should be properly planned to ensure that they can be carried out safely and effectively. Suitable and sufficient assessments of the risks to health and safety arising from particular activities should be carried out.

The nature of the required risk assessment will depend on the extent of the risks involved and may be qualitative or quantitative in nature. The purpose of the risk assessment is to identify the acceptability of the proposed activity and the appropriate control measures required to ensure that risks are as low as reasonably achievable (ALARA). The results of the risk assessment should be incorporated into work instructions or control documentation associated with the activity, for example, the documentation for the permit to work system.

5.10.5.13. Appropriate arrangements should be in place to ensure that safety related activities are adequately controlled to minimize the risks to health and safety. The level of control should depend on the safety significance of the task. Activities with a high level of safety significance should require a specially authorized person to carry out the task, such as the reactor operator. In addition, certain critical activities such as tests and experiments will need to be authorized in advance and will involve the use of a permit to work system. Other control measures should include the use of hold points and verification stages during complex tasks and the control of stores items and test equipment.

5.11.5.14. All safety related activities should be carried out in accordance with written procedures. These define how the activity can be carried out safely and, where appropriate, identify the steps to be taken in the event of an abnormal situation. The procedures should be issued and controlled in accordance with the organization's management system. Further guidance on operating procedures can be found in Ref. Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants, Safety Standards Series No. NS-G- 2.2 [6].

5.12.5.15. All the proposed plant modifications, including organizational changes, should be thoroughly planned. The operating organization should establish a procedure to ensure that the safety significance of any changes is assessed in advance, with the level of assessment based on the safety significance of the changes. This procedure should ensure that the plant limits and conditions are observed and applicable codes and standards are met. Further guidance on the management of plant modifications can be found in Ref.[3].

5.13.5.16. Arrangements should be in place to manage the situations that fall outside normal operating or fault procedures, e.g. abnormal findings from inspections and special tests. These arrangements should ensure that appropriate control is maintained and due consideration is given to the safety implications of the situation. Arrangements to deal with emergencies also need to be at hand. These should cover on-site and off-site responses, including the timely notification of appropriate government, regulatory and support organizations. More information can be found in Ref. Conduct of Operation at Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-2.14 [29].

MONITORING, REVIEW AND CONTINUOUS IMPROVEMENT OF SAFETY PERFORMANCE

5.17. The operating organization should [CR25] establish a system for continuous monitoring and periodic review of the safety performance to ensure that the safety of the plant is maintained and improved. It should [CR26] include self-assessments to identify opportunities for safety performance improvement, using performance indicators to detect any declining safety performance, and monitoring personnel performance and behaviors to detect and prevent any safety issues in the field. Further details on a typical system for continuous monitoring and periodic review can be found in the Annex Attachment 1. An adequate audit and review system should be established to ensure that the safety policy of the operating organization is being implemented effectively and lessons are being learned from its own experience and from others to improve safety performance.

~~The features of the organizational structure and management aspects should be taken into consideration when monitoring and assessing the safety performance of the operating organization or of an individual nuclear power plant.~~

5.18. The operating organization should provide a means for independent safety review oversight. ~~The key to this process is the establishment of an objective self-assessment programme supported by periodic external reviews conducted by experienced industry peers using well established and proven processes.~~ The principal objective is to ensure that, in those matters that are important to safety, safety accountability is supported by arrangements that are independent of the pressures of plant operation. The safety oversight review should be independent of plant operation, and should be conducted on regular intervals to verify that plant management accounts for changes in national and international safety standards, operating practices, technology and effects of plant modifications. Ref. Periodic Safety Review of Operational Nuclear Power Plants, Safety Standards Series No., SSG-25 [15]. The reports resulting from this activity should be formal and should be provided directly to the senior management of the operating organization. Particular attention should be paid to the feedback from experience.

5.18.A Roles, responsibilities and expectations for independent safety oversight should be clearly established and documented.

5.18.B Senior management should provide the necessary resources to support the independent safety oversight function.

5.18.C Expertise from both inside and outside the utility should be used to support

independent safety oversight activities.

5.18.D Independent safety oversight staff should have the necessary experience, training, skills and credibility to perform oversight activities.

5.18.E The effectiveness of independent safety oversight should be periodically evaluated.

5.18.F The operating organization should establish Nuclear Safety Committees on the plant level and the corporate level. The Nuclear Safety Committees should have a formal charter that identifies responsibilities, authorities, and reporting relationships. Some experts from outside the utility, who are highly experienced in nuclear plant operations, should be involved in the Nuclear Safety Committees.

5.19. Safety review procedures should be maintained by the operating organization to provide a continuing surveillance and audit of plant operational safety and to support the plant management in its overall safety responsibilities.

5.20. To monitor safety performance in an effective and objective way, wherever possible and meaningful, the relevant measurable safety performance indicators should be used. These indicators should enable senior managers to discern and react to shortcomings and early deterioration in the performance of safety management within the train of other business performance indicators.

5.14.5.21. However, it should be borne in mind that there is no one single indicator that provides a measure of the safety of a plant. A range of indicators should be considered in order to provide a general sense of the overall performance of a nuclear power plant and its trend over time.

5.21.A A prioritized, long-range plan for systematic self-assessments should be in place. As a minimum, self-assessments should be conducted in those programmes and activities that influence nuclear safety, industrial safety, radiological safety, plant reliability, and regulatory compliance.

5.21.B Management should monitor personnel performance and behaviors in their specific jobs or in training for these jobs. Management expectations should be closely observed during these observations to ensure high standards are being met. An essential element of management observations should be coaching and feedback. This should reinforce positive behaviors and identify performance gaps and development opportunities. The frequency and scope of observations should be based on the

importance of the equipment and activities to safe and reliable plant operation and on the extent of identified problems in these areas.

5.21.C Benchmarking activities should be conducted to identify solutions to specific problems, performance gap (for example, human performance, management system, conduct of operations) or current industry best practice in a specific area. Improvement actions resulting from benchmarking activities should be entered into a formal tracking system.

5.21.D Management should conduct regular performance reviews to assess current performance. Such reviews should involve analyzing the issues contained in a wide variety of information documented within continuous monitoring and periodic review of safety, including the following:

- corrective action data or data trends;
- self-assessment and benchmarking results;
- observation data, by both station personnel and external groups;
- performance indicator information;
- lower-tier issue reporting systems (for example, simulator issue tracking, personnel contamination occurrences);
- independent safety oversight;
- external reviews.

5.22. Issues identified through continuous monitoring and periodic review should [CR27] be evaluated, commensurate with their significance, and if applicable, to conduct appropriate level of analysis to determine the cause(s). Trending of performance should be applied to the data emanating from continuous monitoring and periodic review to identify focus areas and to initiate further analysis. The appropriate corrective actions should [CR28] be identified and implemented as a result of the monitoring and review of safety performance. Arrangements should be in place to ensure that appropriate corrective actions in response to audit and review findings are identified and taken. Progress in taking proposed actions needs to be monitored to ensure that actions are completed within the appropriate time-scales. The completed corrective actions should be reviewed to assess whether they have adequately addressed the issues identified in the audits and reviews.

5.22.A Management should communicate the results of performance assessments to personnel to ensure a common understanding and alignment.

5.22.B Senior managers should create a learning environment that encourages continuous improvement in performance. Management and all personnel of the operating organization should exhibit strong ownership of and involvement in

continuous monitoring and periodic review of safety.

6. PLANT OPERATION MANAGEMENT PROGRAMMES

GENERAL

6.1. In order to achieve the objectives and discharge the responsibilities listed in Section 3 and to exert effective control over the related activities, the operating organization should establish appropriate documented management programmes. For the purpose of this Safety Guide, a 'management programme' consists of a systematic application of planning schedules, procedures, reviews and audits supported by appropriate resources to administer a specific management policy.

6.2. The areas to be covered by various management processes and programmes in accordance with SSR2/2 Rev. 1 overarching requirement, for the safe operation of plant should [CR29] include, but are not limited to, the following:

- Staffing;
- qualification and training and qualification;
- commissioning;
- plant operations;
- maintenance;
- work management;
- outage management;
- foreign material exclusion;
- in-service inspection;
- surveillance;
- equipment qualification;
- fuel management;
- chemistry;
- safety analysis and review;
- nuclear security and physical protection;
- radiation protection;
- non-radiation safety;
- waste management and environmental monitoring;
- emergency preparedness [CR30][CR31] and response;
- severe accident management;
- internal and external hazards;
- quality management;
- human factors;
- feedback of operational experience;
- plant modifications;

- [plant configuration control](#);
- document control and records;
- management of ageing [and LTO](#);
- decommissioning.

6.3. These programmes should be addressed to administrative as well as technical aspects of plant operation and should cover all related activities. Due consideration should also be given to [leadership and management](#) requirements as stated in Ref.[8], [Application of the Management System for Facilities and Activities, IAEA Safety Standards Series No. GS-G-3.1 \[8A\]](#) and [The Management System for Nuclear Installations Safety Guide IAEA Safety Standards Series No. GS-G-3.5 \[8B\]](#).

6.4. The relevant parts of these programmes should be documented and should be available sufficiently in advance to allow the corresponding activities to be reviewed and assessed by plant staff prior to implementation.

6.5. In order to ensure that adequate and appropriate practices are followed in implementing the management programmes, the operating organization should make arrangements for the requisite information to be available from designers, manufacturers and other organizations. Arrangements should also be made with other appropriate operating organizations in order to benefit from their experience.

6.6. These programmes should take account of the management of ageing and decommissioning and therefore should include any requirements that may facilitate the planning of this activity.

6.7. When establishing such programmes, due consideration should be given to:

- objectives to be achieved;
- applicable regulatory requirements;
- policies to be implemented;
- allocation of responsibilities and delegation of authority;
- qualification of personnel involved;
- scheduling of activities to be performed;
- services and facilities required;
- documentation and basic information required;
- feedback of experience;
- reviews to be conducted of programmes and associated procedures;
- the timely resolution of safety problems;
- reports to be produced and records to be kept;
- the information flow required.

6.8. A prerequisite for implementing the appropriate management programme is the

establishment of a comprehensive system of instructions and procedures to cover all relevant technical and administrative aspects. These documents should be prepared by knowledgeable persons and should be ready at the start of each programme. This imposes a major workload which should be taken into account when recruitment and training schedules are being drawn up. The co-operation of experts from manufacturing, design, construction and other organizations can be utilized where such expertise is required.

6.9. When activities which are not included in the normal procedures are proposed, special procedures should be written down in accordance with established procedures which include the contents and the operational details of the proposed activity. Such activities and procedures should be carefully reviewed by appropriate technical staff and approved by management for safety implications. However, the plant management should have the ultimate responsibility to perform the proposed activity. (See Ref.[29])
~~The proposed procedure should be submitted to the regulatory body for approval if so required.~~

6.10. The operating organization should establish a document control system to ensure that all documents affecting activities important to safety are issued, updated, filed and distributed in such a manner as to prevent the use of old revision or superseded documents (see Ref.[8B]).

STAFFING

Ref.[1] requires: Requirement 4: Staffing of the operating organization

The operating organization shall be staffed with competent managers and sufficient qualified personnel for the safe operation of the plant.

6.11. A long term staffing programme ~~Req 4. [11]~~ tied to the long range objectives should be developed by the operating organization to anticipate future personnel needs. This programme should be reviewed and updated periodically to ensure that it is consistent with and supports the long range objectives of the operating organization and the needs of the plants. The staffing programme should include anticipated changes in authorized staffing levels, job assignments for the development of professional and managerial experience and a forecast of personnel needs, losses due to retirement and attrition being taken into account. The long term staffing plan should allow sufficient time for individuals to turn over job responsibilities and should allow for continuity in the conduct of duties.

6.12. On the basis of the objectives, functions and responsibilities of the operating organization discussed in Section 3, a proper definition and detailed analysis of tasks

and activities to be performed should be made; the appropriate staffing and qualification requirements at the different levels in the organization should be determined, and the selection, training and retraining requirements should be specified.

6.13. In establishing the above requirements, the management of the operating organization should recognize that a nuclear programme requires a complex and evolutionary technology, and that such a programme would consequently require highly qualified personnel capable of ensuring efficient and safe operation under normal conditions and proper response under emergency conditions. In particular, proper expertise with respect to plant control under transient conditions should be available at all times on the site. The qualifications, training and experience of all personnel in the operating organization should therefore be suited to their responsibilities and activities.

6.14. Staffing arrangements should take into account:

- the need to involve the operating organization in the review of activities, including those that are conducted during the design, construction and commissioning stages;
- the need to establish timely liaison with the regulatory body, public authorities and other organizations;
- the minimum number of persons necessary for performing all functions with respect to plant operation and emergency ~~situations—preparedness and response~~ including in case of design extension conditions,—emergency preparedness and response^[CR32]^[CR33], with a view to avoiding excessive loads being placed on individuals;
- the need, particularly in the case of remotely located plants, for adequate expertise, special equipment and spare parts to be available locally for dealing with emergency situations until such time as they are augmented from off-site sources;
- the statutory requirements on working conditions;
- the turnover of personnel in the operating organization;
- long term personnel needs for future projects;
- the policy of the operating organization with respect to maintenance and other functions (such as the extent of maintenance carried out on shift, the extent of employment of contractors, repair versus replacement of components, centralized workshops);
- the need for training and retraining of plant personnel.

6.15. Recruitment should start early enough to permit the establishment and proper implementation of selection methods and the timely availability of personnel for preparatory training. This is in order to allow the personnel to perform planned

activities effectively and to be involved in commissioning and, if practical, in construction activities. Further guidance on the recruitment and selection of plant personnel can be found in Ref. [Recruitment, qualification and training of personnel for nuclear power plants Safety Standards Series No. NS-G-2.8](#) [9].

QUALIFICATION AND TRAINING

[Ref.\[1\] requires: Requirement 7: Qualification and training of personnel](#)

[The operating organization shall ensure that all activities that may affect safety are performed by suitably qualified and competent persons.](#)

6.16. The operating organization ~~should~~ [CR34] establish a training and qualification programme to ensure that the needs of the operating organization are evaluated and that the qualification requirements for positions in the organization are established. Only qualified persons ~~should~~ [CR35] be entrusted with functions important to the safe supervision, operation and maintenance of a nuclear power plant. For each category of personnel, there should be the requirement to develop and maintain appropriate competence through education, experience and formal training.

~~6.17. Deleted. Training programmes, based on the specific needs of the organization and the individual, should be established to develop and maintain the technical knowledge and skills of all personnel. A systematic approach to training should be used which will enable a training programme for nuclear power plant personnel to be prepared, analysed, designed, developed and implemented on the basis of an analysis of the responsibilities and tasks of a job.~~

~~6.18. Deleted. The programme should provide training plans and schedules for the various categories of personnel, taking into account the background of the individuals to be trained and the facilities available.~~

~~6.19. Deleted.~~

~~6.19. A training programme should ensure that personnel at all levels of operation of nuclear power plants have the requisite competence. It should identify the activities in which safety is involved, should provide for acquisition of the knowledge and practical experience needed for these activities and should foster a responsible attitude towards all safety matters.~~

~~6.20. Deleted.~~

~~Consideration also should be given to the training needs of contractor personnel to~~

~~ensure that they are qualified to perform their assigned tasks. Assurance should be obtained that contractor personnel have the required qualifications prior to independent involvement in these activities.~~

~~6.20.6.21.~~ Further guidance on the establishment and implementation of the training and qualification programme for nuclear power plant personnel can be found in Ref.[9].

COMMISSIONING

Ref.[1] requires: Requirement 25: Commissioning programme

The operating organization shall ensure that a commissioning programme for the plant is established and implemented.

~~6.21.6.22.~~ Notwithstanding the contractual arrangements for the supply of a new plant, the operating organization should [CR36] ensure that a comprehensive commissioning programme is established and implemented to demonstrate that the plant has been constructed as specified and may be operated in a safe manner. Details of the establishment and implementation of the commissioning programme are given in Ref. [Commissioning for Nuclear Power Plants Specific Safety Guide IAEA Safety Standards Series No. SSG-28](#) [10].

6.23. Deleted.

~~6.22. In view of its role in the subsequent operating phase of the plant, the operating organization should verify that the commissioning programme checks as exhaustively as possible the characteristics of the plant; specifically, the commissioning programme:~~

~~should confirm that the plant as built conforms to design assumptions and requirement and is consistent with the provisions of the safety analysis report;
should ensure that the plant meets the requirements of the regulatory body;
should demonstrate that the operating instructions and procedures are consistent with the design assumptions and requirements and the physical configuration and provide an opportunity for operating personnel to improve their competence; and
should supply information and data necessary to verify the adequacy of provisions made for implementing the management programmes.~~

~~6.23. Deleted. When commissioning activities are conducted under the responsibility of the supplier or other groups, the operating organization should make the necessary arrangements to review and approve these activities at all stages. On~~

~~completion of a stage of activity, regulatory approval should be obtained by the operating organization before moving on to the next stage. More details in SSG 28~~
6.24. ~~deleted~~

PLANT OPERATIONS

Operational limits and conditions, operating procedures

Ref.[1] requires: Requirement 6: Operational limits and conditions

The operating organization shall ensure that the plant is operated in accordance with the set of operational limits and conditions.

Requirement 26: Operating procedures

Operating procedures shall be developed that apply comprehensively (for the reactor and its associated facilities) for normal operation, anticipated operational occurrences and accident conditions, in accordance with the policy of the operating organization and the requirements of the regulatory body.

6.25. For the safe operation of the plant, administrative controls should be established that include operational limits and conditions and operating instructions and procedures. Requirements for review and approval of operating instructions and procedures, particularly at the corporate level, should be specified. These controls constitute the operations programme and should be established before the commencement of operation. In developing operating procedures, consideration should be given to decommissioning where applicable.

~~6.26. Deleted.~~

~~6.26. The operating organization should provide for the development of operating instructions and procedures that:~~

~~ensure that all activities affecting safe operation are covered by appropriate instructions or procedures;~~

~~ensure compliance with operational limits and conditions and regulatory requirements;~~

~~are written and verified by properly qualified persons in accordance with relevant management system requirements;~~

~~are written in clear and understandable language and avoid any confusion and ambiguities;~~

~~are in accordance with design assumptions and design requirements and;~~

~~provide sufficient details to allow the person assigned to perform the activity to do so without direct supervision.~~

6.27. Further guidance on operational limits and conditions and operating procedures can be found in Ref.[6].

Operations by shift crew

6.28. Regardless of the extent of automation of the plant, the final decisions and resulting final responsibilities of the operation should rest with plant operating staff. The operating organization of a site, therefore, should establish shift crews for continuity of the responsibilities in the tasks of plant operation. Examples of tasks or activities to be executed by a shift crew include, but are not limited to, the following:

(1) For normal operation:

- to change the mode of operation;
- to maintain the existing mode of operation;
- to monitor whether selected plant parameters which are displayed in the control room are in the range of normal readings;
- to monitor whether there are any indications of deviations from normal operation by plant walk-through;
- to issue work permits and prepare working conditions by isolation of structures, systems or components or modification of their configurations;
- to cancel work permits and restore normal plant conditions by returning structures, systems or components into service or into normal configurations;
- to keep operational records in accordance to the plant records retention policy and make reports.

(2) For anticipated operational occurrences:

- to monitor the status of the plant when any deviation from normal operation is detected, and to verify that the plant is responding to the situation as designed;
- to take corrective actions in accordance with procedures if the plant is identified to be not responding properly;
- to proceed to a safe state and remain in this condition until exhaustive analysis of the causes of the deviation is completed.

(3) For accident conditions:

- in case a deviation is not corrected, to initiate accident management and emergency ~~measures response~~ [CR37][CR38] in accordance with procedures.

6.28.A. More details can be found in Ref.[29]

6.29. Deleted.

~~The number of operators on each shift and their responsibilities should be determined on the basis of the complexity of the plant, the degree of automation and regulatory requirements.~~

6.30. Deleted.

~~A shift crew should be headed by a shift supervisor and should consist of a sufficient number of trained, qualified and authorized operators and other support staff for all operational states and for unanticipated situations, especially for coping with emergencies. The qualification and authorization of the shift members should be in accordance with regulatory requirements and with the safety standards of the operating organization. Each member of the shift crew should be assigned with a clearly defined authority and responsibility and be positioned in a clear line of command.~~

6.31. Deleted.

~~6.29. A formal communication system should exist between the plant organization and the shift crew for the transmission of orders and for the transfer of information relating to safe operation. As part of this system, plant modifications and major tests should be properly authorized by plant management and controlled by the shift crew. This should include recording of orders and instructions, with affirmations that these orders and instructions have been received and understood by the shift crew.~~

~~6.30.6.32. Deleted. Shift turnover should be carried out in a structured and professional manner. The effectiveness of shift turnover should be enhanced by a written account of the shift activities. The process of shift turnover should identify the persons involved, their responsibilities, the locations and the conduct of shift turnovers, and the method of reporting plant status, including provisions for special circumstances such as abnormal plant status and staff unavailability.~~

6.33. Deleted.

~~The shift crew should perform regular rounds through the plant. The shift supervisor or authorized staff should also walk through the plant periodically.~~

6.34. Deleted.

6.35. Deleted.

~~There should be an effective interface among the shift crew, the technical support group and maintenance groups including contractors. After finishing their work, the shift crew, technical support group and maintenance groups should ensure that structures, systems and components affected by the work are tested and returned to the original or a satisfactory operational state that complies with the operational~~

limits and conditions.

~~Planning of work, outages, modifications and tests should be co-ordinated among the shift crew, the technical support group and maintenance groups to ensure that the plant remains in a safe condition at all times and in accordance with the operational limits and conditions.~~

MAINTENANCE AND OUTAGE MANAGEMENT

Ref.[1] requires: Requirement 31: Maintenance, testing, surveillance and inspection programmes

The operating organization shall ensure that effective programmes for maintenance, testing, surveillance and inspection are established and implemented.

Ref.[1] requires: Requirement 32: Outage management

The operating organization shall establish and implement arrangements to ensure the effective performance, planning and control of work activities during outages.

6.31-6.36. The maintenance programme should ensure that the levels of reliability and effectiveness of all plant structures, systems and components important to safety remain in accordance with the current plant safety analysis and that the safety status of the plant is not adversely affected after the commencement of operation. Additionally, the results of periodic reviews should be incorporated into the maintenance programme.

6.32-6.37. Deleted. The development of the maintenance programme should be initiated early in the design phase in close liaison with the design organization to ensure that the plant is designed to facilitate maintenance. Maintenance activities should be planned in order to achieve the required reliability and availability of plant structures, systems and components while keeping the exposure of personnel ALARA. The results of probabilistic safety assessments (PSAs) and its applications [27] may be incorporated. The operating organization should collect information on the maintenance needs from designers, manufacturers and other operating organizations, to ensure that only the appropriate maintenance practices are established and the necessary maintenance equipment is acquired. The maintenance programme should be reviewed at regular intervals throughout the life of the plant to optimize the programme on the basis of PSAs its applications and operating experience. This optimization should ensure that there is a correct balance between preventive maintenance, predictive maintenance, maintenance during power operation and minimization of breakdown maintenance on safety systems.

6.38. Deleted.

~~The programme should be established at such a time that it can be implemented to the extent necessary to cope with the plant systems as they are put into operation or transferred to the responsibility of the operating organization, whichever comes first.~~

~~6.39. Deleted. The maintenance programme should include provisions for decontaminating plant items to prevent the spread of contamination.~~

6.39A The maintenance programme should include arrangements for effective performance, planning and control of work activities during outages.

~~6.33-6.40.~~ Detailed guidance on the establishment and implementation of the maintenance programme can be found in Ref. [Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-2.6](#) [11].

IN-SERVICE INSPECTION

~~6.34-6.41.~~ In-service inspection is necessary to assess against possible deterioration whether the structures, systems and components important to safety are in an acceptable condition for continued safe operation or whether remedial measures are necessary. Emphasis should be placed on examining critical systems and components of the primary reactor coolant system because of their importance to safety and the possible severity of the consequence of failures. ~~The r~~[Results of the PSA could be used to take advantage of implementing risk-informed ISI and to support decision-making, Ref. Development and Application of Level 1 PSA for NPPs, Safety Standards Series No. SSG-3](#) [26].

SURVEILLANCE

~~6.35-6.42.~~ The surveillance programme should ensure that items important to safety continue to perform in accordance with the original design assumptions and intent and may incorporate the results of PSAs and feedback from operating experience. The programme should include requirements for evaluation and review to detect in a timely manner degradation and ageing of structures, systems and components that could lead to unsafe conditions. This programme should cover monitoring, checks and calibration, and testing and inspection complementary to the in-service inspection.

~~6.36-6.43.~~ The programme should be developed sufficiently in advance of

plant commissioning to permit it to be properly implemented as plant items become operational during the commissioning phase, and to ensure that the safety of the plant is not dependent upon untested or unmonitored structures, systems and components. Additional guidance on the surveillance programme can be found in Ref.[11].

EQUIPMENT QUALIFICATION

6.43.A. [CR39]The operating organization should [CR40]implement the Equipment Qualification (EQ) programme whose objective is to provide assurance that items important to safety at a nuclear power plant are qualified for their intended function in their anticipated environmental conditions during their service life, and that the qualification provides confidence that the items will perform commensurate with the importance to safety of the system or component.

6.43.B. The equipment qualification programme should cover all aspects of the qualification process and all related activities which are needed to establish and preserve the qualified status of equipment items important to safety.

6.43.C. The equipment qualification programme should address all topics affecting the suitability of the system or component for its intended functions important to safety, including:

- Suitability and correctness of functions and performance;
- Environmental qualification (i.e. qualification for temperature, pressure, humidity, chemical exposure, radiation, submergence, electromagnetic phenomena and ageing mechanisms);
- Electromagnetic qualification;
- Qualification for the effects of internal and external hazards.

6.43.D. The equipment qualification programme should [CR41]be periodically reviewed to determine whether plant equipment important to safety has been properly qualified (including for environmental conditions) and whether this qualification is being maintained through an adequate programme of maintenance, inspection and testing that provides confidence in the delivery of safety functions until at least the next review. Configuration management procedures should be applied to ensure that EQ implications are appropriately considered whenever changes occur to the MS&I activities.

6.43.E. The equipment qualification programme should take into account plant and equipment modifications, equipment repairs and refurbishment, equipment failures and replacements, any abnormal operating conditions and changes to the safety analysis.

6.43.F. Operating experience feedback should be used for identifying unanticipated

changes in service conditions or equipment performance and by monitoring of environment and equipment, establishing data to support ongoing qualification of installed equipment.

6.43.G. Additional information on the equipment qualification and its assessment can be found in the Refs.[3], [5], [10] and [11].

FUEL_MANAGEMENT

Ref.[1] requires: Requirement 30: Core management and fuel handling

The operating organization shall be responsible and shall make arrangements for all activities associated with core management and with on-site fuel handling.

6.44. The fuel management programme should address those activities that are needed in order to allow optimum reactor core operation without compromising the limits imposed by the design safety considerations relating to the nuclear fuel and the plant as a whole. Special consideration should be given to the safety aspects of core management, fuel procurement, site storage, irradiation, and handling and transport of fuel, for which the operating organization is responsible.

In particular, the fuel management programme should cover:

- the establishment of detailed technical specifications and quality assurance requirements for fuel procurement;
- special studies to be undertaken to demonstrate the ability of new or modified fuel to meet the provisions of the safety analysis report, especially when fuel from different suppliers is to be placed in the reactor core;
- arrangements to ensure safety during transport, storage and handling of new and irradiated fuel;
- establishment of core calculation programmes to define fuel and absorber loading patterns, so as to maintain compliance with reactivity, temperature and irradiation or burnup limits;
- core monitoring to ensure that core parameters which are indicative of conformance with design and operational limits are monitored, trended and evaluated to detect abnormal behaviour;
- fuel monitoring to ensure that fuel cladding integrity is maintained under all core operating conditions;
- implementation of applicable requirements for the examination of irradiated fuel, and use of the results to monitor fuel performance; and
- verification of the startup testing methods and establishment of associated surveillance requirements.

6.44.A. More detailed guidance on core management and fuel handling can be found in Ref. Core Management and Fuel Handling in Nuclear Power Plants, Safety Standards Series No. NS-G-2.5 [13].

CHEMISTRY

Requirement 29: Chemistry programme

The operating organization shall establish and implement a chemistry programme to provide the necessary support for chemistry and radiochemistry.

6.37.6.45. The chemistry programme should provide the necessary chemical and radiochemical assistance to ensure safe operation, the long term integrity of systems and components, and control and reduction of radiation levels in working areas. The programme should include monitoring, analyses, instructions for operations involving chemical processes and evaluation of operating results. In many power plants, the chemical and radiochemical activities may include environmental monitoring, in particular when the activities relating to chemistry and radiation protection are all performed by one group. More information can be found in Ref. Chemistry Programme for Water Cooled Nuclear Power Plants, Specific Safety Guide, IAEA Safety Standards Series No. SSG-13 [30].

SAFETY ANALYSIS AND REVIEW

6.46. To ensure a high degree of safety, the operating organization should establish a safety review process that could be implemented by a safety review group or independent reviewers and which provides an independent evaluation of the operational activities of the plant. Safety reviews should be considered for activities such as:

- reviewing the safety related aspects of plant operation;
- monitoring the safety performance of the plant and personnel (including the safety performance indicators);
- reviewing OLCs and their modifications;
- reviewing plant MS&I programmes;
- reviewing deviations from OLCs and operation outside the OLCs, reviewing events leading to unplanned shutdown and other operational occurrences, participating in the review of accidents, reviewing malfunctions, failures and precursors to assess their importance to safety and suggesting actions both to

- correct adverse situations and to improve safety;
- assessing cumulative effects on safety of equipment failures and modifications including temporary modifications;
- reviewing modifications and related testing plans to ascertain that they meet the safety requirements and do not compromise safety;
- performing a specific safety review for non-routine activities and special tests;
- reviewing the safety of outages;
- reviewing the effectiveness of the safety management system and its implementation against the best international practices; and reviewing changes to the management system including organizational changes;
- reviewing proposed corrective actions based on audits and reviews;
- suggesting corrective actions and/or modifications.

6.38-6.47. Safety reviews should be conducted in sufficient depth to ensure that all issues and questions raised by the review can be satisfactorily resolved. Safety review activities should be performed by personnel who have sufficient education, nuclear experience, expertise and training to allow a thorough understanding and evaluation of the items reviewed.

6.39-6.48. The self-assessment of operational safety is an important safety review mechanism that the operating organization can use to improve safety. Self-assessment is a structured, objective and visible procedure or set of procedures whereby individuals, groups and management within an operating organization evaluate the effectiveness of their own operational safety against predetermined targets, goals and other performance expectations. The self-assessment process is only complete when the corrective actions have been implemented and their adequacy has been confirmed.-

6.40-6.49. In addition, periodic safety reviews should be performed to substantiate a high level of safety throughout the operating lifetime of the plant as required by Ref.[1]. The results of periodic safety reviews should be used, for example:

- to confirm that the nuclear power plant or individual items can be operated safely for a defined period of future operation;
- to identify and evaluate factors that could limit safe operation during the defined period;
- to revise the existing safety analysis report to meet current national and international safety standards and operating experiencepractices;
- to provide input to long term operation studies;
- to support decision making process for license renewal and/or for long term operation.

~~6.41-6.50.~~ The prime responsibility for performing periodic safety reviews rests with the operating organization. The scope and periodicity of a periodic safety review should either be specified by the regulatory body or be developed by the operating organization and agreed upon with the regulatory body. Additional guidance on periodic safety reviews can be found in Ref.[15].

NUCLEAR SECURITY ~~PHYSICAL PROTECTION~~

Ref.[1] requires: Requirement 17: Consideration of objectives of nuclear security in safety programmes

The operating organization shall ensure that the implementation of safety requirements and security requirements satisfies both safety objectives and security objectives.

The nuclear safety and security measures have the common aim of protecting people, society and the environment from the radiological hazards.

Security measures and safety measures have to be designed and implemented in an integrated manner so that security measures do not compromise safety and safety measures do not compromise security.

Additional guidance on the physical protection of nuclear power plants and nuclear materials can be found in IAEA Nuclear Security Series publications, especially in the Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5), IAEA Nuclear Security Series No. 13 [16A] and Physical Protection of Nuclear Material and Nuclear Facilities (Implementation of INFCIRC/225/Revision 5), IAEA Nuclear Security Series No. 27-G [32].

[CR42]

~~6.42. The operating organization should provide physical protection that prevents or deters unauthorized access, intrusion, theft, surface attack and internal or external sabotage of systems important to safety and nuclear materials.~~

~~6.43. The operating organization should have plans and procedures in place to provide physical protection of the site through vehicle entrance and exit control, vehicle parking and traffic control and personnel access control.~~

~~6.44. Protection against external or internal malevolent actions which could jeopardize safety should be provided. Consideration should therefore be given to:~~

~~— access controls around the site and within the plant area;~~

- access rules to be observed for different zones of the site, and provisions to detect and prevent or delay unauthorized entry;
- establishment of procedures for access authorization;
- selection and training of physical protection personnel;
- communication systems to be used.

Appropriate physical protection arrangements should be implemented as soon as any plant items important to safety are received on the site, before commencement of commissioning, and in any case before the arrival of fuel on the site. Additional information on the physical protection of nuclear power plants and nuclear materials can be found in Ref. Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5) Recommendations IAEA Nuclear Security Series No. 13 [16A] and, Establishing the Nuclear Security Infrastructure for a Nuclear Power Programme Implementing guide IAEA Nuclear Security Series No. 19 [16B].

6.54A Safety measures, nuclear security measures and arrangements for the State system of accounting for, and control of, nuclear material for a nuclear power plant should be implemented in an integrated manner so that they do not compromise one another.

6.54.B The operating organization should arrange an appropriate interface between safety and security measures. Some actions that are taken for security reasons, such as limitations on access or egress from a nuclear facility, may serve to inhibit safety or emergency response. Also, some areas may need to be dealt with differently in the two spheres, such as the management of information and the involvement of interested parties.

6.54.C The operating rules and procedures should take into account the respective safety or security considerations and provisions implemented should reflect an appropriate balance between safety and security objectives.

6.54.D The operating organization should ensure a close cooperation between safety and security specialists. When conflict is unavoidable, the matter should be considered from both safety and security perspectives and resolved based on the philosophy of minimizing the overall risk to the public.

6.54.E The operating organization should protect digital computer and communications systems and networks performing the following categories of functions from cyberattacks that could act to modify, destroy, or compromise the integrity or confidentiality of data and/or software; deny access to systems, services, and/or data, and; impact the operation of systems, networks, and associated equipment:

- ~~(a) Safety related and important to safety functions;~~
- ~~(b) Security functions;~~
- ~~(c) Emergency preparedness functions, including offsite communications; and~~
- ~~(d) Support systems and equipment which, if compromised, would adversely impact safety, security, or emergency preparedness functions.~~

RADIATION PROTECTION

Ref.[1] requires: Requirement 20: Radiation protection

The operating organization shall establish and implement a radiation protection programme.

6.45:6.51. The radiation protection programme should include arrangements for monitoring and dose assessment and should ensure that doses to individuals remain within the prescribed limits; its objective should be that individual and collective doses are kept as low as reasonably achievable. The radiation protection programme is subject to the requirements of, and should be established in accordance with, the basic principles and objectives presented in Ref. Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, General Safety Requirements, IAEA Safety Standards Series No. GSR Part 3 [17]. ~~Reference [18] provides further recommendations and guidance on the radiation protection programme.[CR43]~~

6.55A Appropriate specialist services should be provided to give advice and technical support on:

- specification of radiological laboratories for monitoring personnel and the environment;
- radiological aspects of commissioning and operation, including emergency arrangements;
- evaluation of operating experience in the radiological area;
- radiological aspects of plant modifications;
- development of techniques and equipment to reduce personnel doses;
- compliance with statutory requirements and methods of ensuring satisfactory evidence of compliance with these requirements in relation to: authorization to discharge radioactive effluents, transport of radioactive material and on-site management of contaminated waste (e.g. by incineration).

6.55B The operating organization, which is responsible for a number of plants and which utilizes mobile teams of personnel for certain functions, should control individual exposure using a central record-keeping system. Similar requirements should be applied if

services of contractors or other outside agencies are utilized extensively.

6.55C Suitable medical advice and appropriate bioassay facilities should be made available so that appropriate medical examinations of personnel employed in the process can be performed and advice on specific radiological medical problems can be provided. Stand-by provision of hospital services should be arranged to cover the possibility that medical assistance involving radiological factors may be required.

NON-RADIATION RELATED SAFETY ~~INDUSTRIAL SAFETY~~

Ref.[1] requires: Requirement 23: Non-radiation-related safety

The operating organization shall establish and implement a programme to ensure that safety related risks associated with non-radiation-related hazards to personnel involved in activities at the plant are kept as low as reasonably achievable.

6.52. A ~~non-radiation related~~ safety policy and programme should be established and implemented to ensure that all risks to personnel involved in plant activities, in particular, those activities that are safety related, are kept ALARA. A ~~non-radiation related~~ safety programme should be established for all personnel, suppliers and visitors, and should refer to the non-radiation safety rules and practices that are to be adopted. The programme should include arrangements for the planning, organization, monitoring and review of the preventive and protective measures. The operating organization should provide support, guidance and assistance for plant personnel in the area of non-radiation related safety.

6.56.A The operating organization should assign the responsibilities for non-radiation-related safety supervision.

6.56.B Plant staff and contractors should receive an appropriate training on non-radiation-related safety.

WASTE MANAGEMENT AND ENVIRONMENTAL MONITORING

Ref.[1] requires: Requirement 21: Management of radioactive waste

The operating organization shall establish and implement a programme for the management of radioactive waste.

~~6.46-6.53.~~ The environmental monitoring programme should ensure that gaseous and liquid releases from the operation of the nuclear power plant are

satisfactorily controlled and monitored so that authorized discharge limits are complied with, and kept as low as reasonably achievable, as detailed in Ref. Predisposal Management of Radioactive Waste from Nuclear Power Plants and Research Reactors Series No. SSG-40 [27].

EMERGENCY PREPAREDNESS

Ref.[1] requires: Requirement 18: Emergency preparedness

The operating organization shall prepare an emergency plan for preparedness for, and response to, a nuclear or radiological emergency.

6.54. The operating organization should establish the necessary organizational structure and should assign responsibilities for emergency preparedness and response. This includes arrangements for (i) timely notification, alerting and activation of sufficient trained and qualified response personnel to manage the response, to take mitigatory actions, to assess the emergency, to protect people on the site, and to advise public authorities on the implementation of urgent protective actions off the site; (ii) provision for co ordination of the response on the site with the response by off-site response organizations; (iii) provision of the necessary information and of support to, and co-operation with, the relevant public authorities; and (iv) timely notification and provision of information in the framework of the Convention on Early Notification of a Nuclear Accident Convention on Early Notification of a Nuclear Accident and Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Legal Series No. 14, IAEA, Vienna (1987) [19]. Requirements on the preparedness of the operating organization for emergencies can be found in Ref. [20]. [CR44]

The operating organization should establish the necessary organizational structure and should assign responsibilities for emergency preparedness and response as required in GSR Part 7 [Ref.[20]. This includes arrangements for (i) timely notification, alerting and activation of sufficient trained and qualified response personnel to manage the response, to take mitigatory actions, to assess the emergency, and to protect people on the site including emergency workers^[1] and to provide sufficient information for an effective off-site response; (ii) provision for co-ordination of the response on the site with the response by off-site response organizations; (iii) provision of provide sufficient information for an effective off-site response to off-site authorities; and (iv) timely notification and provision of information in the framework of the Ref. Convention on Early Notification of a Nuclear Accident and Convention on Assistance in the Case of a Nuclear Accident or Radiological

^[1] This includes those employed directly or indirectly (through contractors) by the licensee as well as personnel of off-site response organizations supporting the on-site emergency response.

Emergency, Legal Series No. 14 [19], Ref. Requirements and guidance on the emergency preparedness and response of the operating organization can be found in Ref.[20] and Ref. Arrangements for Preparedness for a Nuclear or Radiological Emergency, Safety Guide No.GS-G-2.1 [20A].; GS-G-2.1, GSG 2, GSG-11][CR45][CR46][CR47]

6.58.A The roles and responsibilities of contractors working at a nuclear facility in an emergency should to be well defined at the preparedness stage to allow for protection of the contractors, as appropriate. Those contractors who may have a role and responsibilities in emergency response should be designated as emergency workers in advance of the emergency, and appropriate protection, including training, provided to them.[CR48][CR49]

SEVERE [CR50]ACCIDENT MANAGEMENT

Ref.[1] requires: Requirement 19: Accident management programme

The operating organization shall establish, and shall periodically review and as necessary revise, an accident management programme.

6.58.B [An accident management [CR51][CR52][CR53]programme should be developed and implemented for ^[1]_{SEP}prevention and mitigation of accidents irrespective of the core damage frequency and ^[1]_{SEP}fission product release frequency.-

~~6.58.C The accident management programme should address all [CR54][CR55]appropriate modes/states of operation and fuel locations, including spent fuel pool, taking into account possible combinations of ^[1]_{SEP}events that could lead to accident conditions. It should also consider extreme external hazards that could result in significant damage to the infrastructure onsite or offsite.~~

~~6.58.D For a multi unit nuclear power plant site where several units are co-located, the accident management programme should consider concurrent severe [CR56][CR57]accidents on multiple units.~~

6.58.E Further guidance is provided in Ref. Severe Accident Management Programmes for Nuclear Power Plants, Safety Guide IAEA Safety Standards Series No. NS-G-2.15 [28].

FIRE SAFETY

Ref.[1] Requires Requirement 22: Fire safety

The operating organization shall make arrangements for ensuring fire safety.

~~6.47.6.55.~~ The operating organization should make arrangements for ensuring fire safety on the basis of a fire hazard analysis which should be periodically updated. Such arrangements should include: application of the principle of defence in depth; assessment of the impact of plant modifications on fire fighting; control of combustibles and ignition sources; inspection, maintenance and testing of fire protection measures; establishment of a manual fire fighting capability; and training of plant personnel. For further guidance see Ref. [Fire Safety in the Operation of Nuclear Power Plants, Safety Standards Series No. NS-G-2.1](#) [21].

MANAGEMENT SYSTEM ~~QUALITY ASSURANCE~~

Ref.[1] requires: Requirement 2: Management system

The operating organization shall establish, implement, assess and continually improve an integrated management system.

~~6.56.~~ The operating organization should prepare and implement a comprehensive management system ~~programme~~ covering all activities which may have an influence on the safe operation of the nuclear power plant. More details can be found in Refs.[8], [8A] and [8B].

~~The programme should meet the requirements of the Code on Quality Assurance for Safety in Nuclear Power Plants and Other Nuclear Installations [8] and should be made available to the regulatory body.~~

HUMAN PERFORMANCE AND HUMAN ERROR PREVENTION TOOLS

~~6.48.6.57.~~ A suitable working environment should be provided and maintained so that work can be carried out safely and satisfactorily, without imposing unnecessary physical and psychological stress on personnel. Human factors which influence the working environment and the effectiveness and fitness of personnel for duty should be identified and addressed. The operating organization should establish an appropriate programme for these purposes. Examples of areas or activities to be reflected in this programme should include, but are not limited to, the following:

- adequacy of the resources, support and supervision provided to manage and perform the work;
- adequacy of lighting, access and operator aids;

- adequacy of alarms, considering factors such as their number, position, grouping, colour coding and prioritizing for audibility;
- frequency and clarity of communications;
- availability of suitable tools and equipment;
- duration of work time for personnel;
- the attention needed to be given to other factors, in particular for control room staff, including well-being, psychological and attitudinal problems, shift patterns and meal breaks;
- the availability of procedures that take into account human factor considerations.

6.61.A Leaders should reinforce the standards and behaviors to reduce the likelihood for human error and to achieve sustainable and safe operation.-

6.61.B Human performance standards and expected behaviors should be defined, established and incorporated in an organization's programmes, processes and training. Human performance tools should consist of two parts:

- anticipating, preventing, catching and recovering from errors on the job;
- identifying and eliminating organizational weaknesses, which induce and set individuals up for failure, by establishing and managing error defences.

6.61.C A set of human performance tools that focus on anticipating, preventing and catching active errors before they become events should be used. These tools are categorized into fundamental tools which should be used and include:

- Situational awareness;
- Task preview;
- Job-site review;
- Questioning attitude;
- Self-checking;
- Stop when unsure;
- STAR: Stop, Think, Act, Review;
- Procedure use and adherence;
- Effective communication e.g.;
 - Three-way communication;
 - Phonetic alphabet.

Conditional human performance tools should be used depending on the work situation:

- Pre-job briefing;

- Verification practices, including concurrent verification, independent verification and peer checking;
- Flagging;
- Keeping track in procedures step-by-step (place keeping);
- Post-job review.

6.61.D Initial and continuing training programmes should incorporate human performance standards and practices, and provide the necessary skills and knowledge to understand conditions that lead to human error.

6.61.E Periodic safety reviews shall include review of the human factors to verify that the human factors within the operating organization correspond to accepted good practices and support safety. More information can be found in Ref.[15].

FEEDBACK OF OPERATING EXPERIENCE

Ref.[1] requires: Requirement 24: Feedback of operating experience

The operating organization shall establish an operating experience programme to learn from events at the plant and events in the nuclear industry and other industries worldwide.

~~6.49-6.58.~~ An effective programme for the review of operating experience should be established to provide methods to analyse both in-house events and events in the nuclear industry generally so as to identify plant specific actions needed to prevent the occurrence of similar events. In-house events of interest to other plants should be shared with the industry to prevent the occurrence of similar events. The effectiveness of the operating experience review programme should be assessed periodically to identify areas of weakness that require improvement.

~~6.50. Delete.~~ Overall responsibility for implementing the operating experience review programme can be placed in either the nuclear power plant or the operating organization. However, the involvement and support of senior management of the operating organization are key for an operating experience review programme to be effective.

~~6.51. The line management of a plant should be responsible for assisting in the review of operating events and for specifying and taking corrective actions.~~

~~6.52-6.59.~~

~~6.53-6.60. Deleted.~~ The operating experience at the plant should be evaluated in a systematic way, primarily to make certain that no safety relevant event goes undetected. Low level events and near misses should be reported and reviewed thoroughly as potential precursors to degraded safety performance. Abnormal events important to safety should be investigated in depth to establish their direct

~~and root causes. Probabilistic Safety Analysis can be used for analysis of potential consequences of operating events to complement deterministic analysis thus providing quantitative indication of the risk significance. More information can be found in Ref. [26]. Methods of human performance analysis should be used to investigate human performance related events. The investigation should result in clear recommendations to plant management, which should take appropriate corrective action without undue delay to prevent recurrence.~~

~~6.54.6.61. Deleted. Similarly, the operating organization should obtain and evaluate information on operating experience at other plants that provides lessons for the operation of its own plant. To this end, the exchange of experience and its contribution to national and international organizations should be considered to be of paramount importance.~~

~~6.55.6.62. Deleted. Operating experience should be carefully examined by designated competent persons to detect any precursor signs of possible tendencies adverse to safety, so that corrective action can be taken before serious conditions arise. Trending should identify recurring similar events and continued problems based on the causes and initiators of previous events. Event trend reviews and conclusive interpretations should be provided periodically to the plant manager and to the management of the operating organization.~~

~~6.56.6.63. Deleted. The responsibilities, qualification criteria and training requirements of personnel performing activities to review operating experience should be clearly defined. Personnel who conduct investigations of abnormal events should be provided with training in investigative root cause analysis techniques such as accident investigation, human factor analysis (including organizational factors), management oversight and risk tree analysis, change analysis and barrier analysis. Event investigators should be knowledgeable of plant design, procedures and operations.~~

~~6.64. Deleted-~~

~~All plant personnel should be encouraged to report all events and near misses relevant to the safety of the plant. All plant personnel should be given the opportunity to report all events and near misses. It is the responsibility of plant management to review and respond to these submissions in a timely and confidential manner.~~

~~6.65. Deleted-~~

~~6.57. Where applicable, lessons learned from industry and in house experience should be transmitted to the training department as soon as possible for determination of the type of training to be implemented to most effectively communicate the lessons learned.~~

~~6.66. Deleted.~~

~~Data from operating experience should be collected, retained and thoroughly reviewed for use as input to residual life evaluation, probabilistic safety assessment and periodic safety review.~~

~~6.58-6.67.~~ Detailed guidance on establishing the operating experience feedback system can be found in Ref. [A System for the Feedback of Experience from Events in Nuclear Installations, IAEA Safety Standards Series No. NS-G-2.11](#) [22].

CONTROL OF PLANT CONFIGURATION AND PLANT MODIFICATIONS

Ref.[1] Requires: Requirement 10: Control of plant configuration

The operating organization shall establish and implement a system for plant configuration management to ensure consistency between design requirements, physical configuration and plant documentation.

Requirement 11: Management of modifications

The operating organization shall establish and implement a programme to manage modifications.

~~6.59-6.68.~~ The operating organization should establish a procedure to ensure that all permanent and temporary modifications are properly identified, specified, screened, designed, evaluated, authorized, implemented and recorded. ~~This procedure should ensure that the plant's design basis is maintained, limits and conditions are observed, design requirements and, applicable codes and standards are met. A record of the review shall be made available to the regulatory body. The operating organization maintains responsibility for safety implications of the modification and for obtaining the appropriate review and approval by the regulatory body if required.~~

~~6.60-6.69.~~ Requests for modification should be evaluated on the basis of their impact on plant safety and reliability, plant operation and performance, personnel safety and the fulfilment of regulatory requirements. Considerations should include the need for training upgrades and associated hardware.

6.70. Before commissioning of the modification affected plant personnel should be trained appropriately and all relevant design and operational documents and computer software programs shall be revised and updated. Detailed guidance on the

establishment and implementation of the plant modification programme can be found in Ref.[3].

6.74.A The operating organization shall establish and manage a system for plant configuration control to ensure consistency between design requirements, physical configuration and plant documentation. Refs.[1] and [8B].

6.74.B The operating organization should internally set up a formal process to maintain the design integrity as soon as it takes control of the plant. There should be a formally designated entity (Design Authority) within the operating organization that takes responsibility for this process. This entity should formally approve all design changes. To do this, it should have sufficient knowledge of the design and of the overall basis for safety. The design authority should have the necessary interfaces with the responsible designers. In addition, it should have access through a formal process to all the underlying design basis to ensure that the original intent of the design is maintained. Ref. Safety of Nuclear Power Plants: Design Safety Standards Series No. SSR-2/1 (Rev. 1) [1A].

6.74.C IT support of configuration management should be planned from the very beginning of the preparation and construction of a new nuclear power plant. It is important for the operating organization to have a data structure that will support nuclear power plant construction, commissioning, operation and decommissioning. Data, obtained during nuclear power plant construction and commissioning, will need to be readily accessible for use during operation as well.

DOCUMENT CONTROL AND RECORDS

Ref.[1] requires: Requirement 15: Records and reports

The operating organization shall establish and maintain a system for the control of records and reports.

6.74.D The operating organization should establish document control and records management in order to properly manage facility configuration documentation (including electronic information control). The documentation should be kept current with the changes in plant configuration and design requirements.

6.71. Documentation should be controlled in a consistent, compatible manner throughout the plant and the operating organization. This includes the preparation, change, review, approval, release and distribution of documentation. Particular care should be taken in order that, although all versions of each document are appropriately

filed and kept as a reference, only the correct, up to date versions are available to the site personnel for day to day activity.

~~6.61~~6.72. A records administration and documentation system should be established to ensure the appropriate keeping of all documents relevant to the safe and reliable operation of the plant, including design documents, commissioning documents, and documents relating to the operational history of the plant as well as general and specific procedures. Particular care should be taken in order that, although all versions of each document are appropriately filed and kept as a reference, only the correct, up to date versions are available to the site personnel for day to day activity. Further guidance on the document control system can be found in Ref.[8].

6.76.A. The operating organization should identify the types of records and reports that are relevant to safe operation of the plant, including design documents, commissioning documents, records of operation, including maintenance and surveillance and documents relating to the operational history of the plant as well as general and specific procedures. Retention times of records should be established in accordance with the statutory requirements. Records should be easily retrievable and readable for the duration of the retention time of each record.

6.76.B. The operating organization should ensure appropriate conditions for the storage of safety related records for permanent retention so as to prevent deterioration (fire protection, security, environmental conditions, duplication of records and separate storage).

MANAGEMENT OF AGEING AND LONG TERM OPERATION

Requirement 14: Ageing management

The operating organization shall ensure that an effective ageing management programme is implemented to ensure that required safety functions of systems, structures and components are fulfilled over the entire operating lifetime of the plant.

Requirement 16: Programme for long term operation

Where applicable, the operating organization shall establish and implement a comprehensive programme for ensuring the long term safe operation of the plant beyond a time-frame established in the licence conditions, design limits, safety standards and/or regulations.

~~6.62~~6.73. Managing the safety aspects of nuclear power plant ageing

requires implementation of effective programmes for the timely detection and mitigation of ageing degradation of plant structures, systems and components important to safety, so as to ensure their integrity and functional capability throughout the plant's service life.

~~6.77A Ageing of in scope SSCs should be managed with foresight and anticipation through the entire lifetime of the plant, i.e. in design, construction, commissioning, operation and decommissioning. Management of ageing effects should be considered during all associated activities, such as engineering, procurement, fabrication, transport and installation.-~~

~~6.63.-Deleted. The programme to manage the ageing process should contain, but is not limited to, such elements as:~~

~~6.64.-~~

~~6.65. identification of the degradation processes that could adversely affect plant safety;~~

~~6.66. identification of components that are susceptible to ageing degradation that could affect plant safety;~~

~~6.67. adequate and current methods for the detection of ageing problems;~~

~~6.68. appropriate records to enable the ageing process to be tracked;~~

~~6.69. a methodology for corrective action in order to mitigate and/or remove ageing effects; and~~

~~6.74. changes to the maintenance, testing, surveillance and in-service inspection programme to reflect the analysis of ageing test results.~~

6.78.A If long term operation (operation beyond the original design lifetime) is being considered, the operating organization should establish policy documents, dedicated organizational structures and action plans to perform evaluations for long term operation well before the plant enters into long term operation. The operating organization should specify subjects for evaluation for long term operation and should assess the current physical status of relevant SSCs during the preparation phase for long term operation. More information on specific ageing management and long term operation topics can be found in Ref. [Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants, IAEA Safety Standards Series No. SSG-48 \[23\]](#).

PREPARATION FOR DECOMMISSIONING

Ref.[1] requires: Requirement 33: Preparation for decommissioning

The operating organization shall prepare a decommissioning plan and shall maintain it throughout the lifetime of the plant, unless otherwise approved by the regulatory

body, to demonstrate that decommissioning can be accomplished safely and in such a way as to meet the specified end state.

~~6.70.6.75. An outline decommissioning plan should normally be completed during the design phase of the nuclear power plant. This plan should be amended as necessary during the operation stage, on the basis of operating experience and the latest developments in decommissioning techniques. In implementing operational strategies, potential problems during decontamination should be taken into account. For example, consideration should be given to: replacing shielding that could become activated with material that is easier to decontaminate; minimizing the contamination of structures and surfaces; segregating wastes of different categories; using protective coating; and containing contaminated materials.~~

~~6.71.6.76. Deleted. Management should ensure that all decommissioning options are considered and that a decommissioning strategy is developed. Factors influencing all the options should be considered before a decision is taken on the final option. The overall decommissioning plan should cover all decommissioning phases of the nuclear power plant, from the start of decommissioning until the site and its adjacent areas are rendered fit for their anticipated use. To implement the strategy, a final decommissioning plan should be developed which should be made up of separate documents and should be produced in stages, with an overall plan and then more detailed plans for each decommissioning phase. Further guidance on decommissioning can be found in Ref. [25].~~

~~6.72.6.77. Deleted. All important information associated with future decommissioning should be adequately recorded, categorized for retention and stored so that the information is retrievable for future use. More information on document control for decommissioning needs can be found in Ref. [8], Safety Guide Q14.~~

6.81.A The organizational structure should reflect organizational changes during the transitional period, such as changes of internal interfaces and external interactions, as well as changes in the roles and responsibilities of plant personnel.

6.81.B The operating organization should ensure the availability of adequate resources (including funds, people, equipment and time) to properly manage the plant transition from operation to decommissioning.

6.81.C The operating organization should develop and implement methods to keep staff motivated and to retain the required pool of skilled and experienced personnel. Further guidance on decommissioning can be found in Ref. [Decommissioning of](#)

7. SUPPORTING FUNCTIONS

GENERAL

~~7.1.7.2.~~ Certain services and facilities that are complementary to the functions for the direct operation of the nuclear power plant should be provided for the effective implementation of the management programmes and for ensuring safe operation of the plant. These are called ‘supporting functions’. The ‘services’ are the expertise and assistance made available to the plant management to support the operation of the nuclear power plant. The ‘facilities’ are the equipment and systems necessary for these services.

~~7.2.7.3.~~ Depending on national practices and the extent of the nuclear power programme of an operating organization, these services and facilities may be provided either from within the organization or from outside sources, as appropriate. Whatever their source, they should be co-ordinated with the activities of the plant management and the arrangements should be sufficiently comprehensive to enable the management programmes to be implemented effectively.

~~7.3.7.4.~~ Examples of areas or activities that should be taken into consideration in connection with the supporting services provided by the operating organization to a nuclear power plant should include, but are not limited to, the following:

- ~~— training of personnel;~~
- ~~— quality assurance;~~
- ~~— radiation protection and emergency preparedness;~~
- ~~— maintenance, surveillance and in service inspection;~~
- ~~— waste management and environmental monitoring;~~
- ~~— safety review and assessment, including review of safety management;~~
- ~~— core management and fuel handling, including procurement arrangements; and~~
- ~~— major modifications.~~

~~7.4.7.5.~~ The operating organization should arrange for the availability of personnel competent to undertake and/or sponsor independent assessments of design studies and development work for modifications on plant items important to safety. This service may be called on to provide assistance in the production of plant specifications, assessment of proposed designs and supervision of the engineering work.

~~7.5.7.6.~~ Appropriate services should be provided by the operating organization to assist

the plant management in such areas as probabilistic methods in safety assessment, maintenance, planning for surveillance and in service inspection, organization for the human-technology interface and methodology for human performance analysis.

~~7.6.7.7. The operating organization should ensure that separate operation management programmes (see Section 6) are efficiently integrated to optimize the day to day operation of the plant. For co-ordinating activities to have a bearing on safety and to assist in the prevention or resolution of conflicts, this integration should be undertaken throughout the operating organization under the direction of a designated person.~~

TRAINING SERVICES

~~7.7.7.8. In countries with limited educational or industrial infrastructure, special training should be fostered to achieve the required competence. The training of maintenance personnel may be augmented by periods of secondment to manufacturers' establishments or detachment to construction or commissioning crews.~~

~~7.8.7.9. When a new nuclear power plant becomes operational for the first time, some of the personnel will probably be inexperienced and a very resource intensive period of staff training will be conducted. During this initial training period, the operating organization should provide additional support to the plant. The services offered by reactor vendors for the training of operators and by component manufacturers for the training of technicians and maintenance personnel should be used and may be supplemented by the services of research and development organizations and of consultant organizations offering training services.~~

~~7.9.7.10. In the long term, the operating organization should consider how it might influence the training and qualification system. It should establish good relations with local educational institutions and encourage the development of courses especially adapted to the needs of nuclear power plant operation.~~

~~7.10.7.11. In providing external services for training of the plant personnel, the operating organization should consider such resources as reactor vendors, manufacturers of the nuclear equipment, other nuclear utilities, consulting companies and international organizations. Training provided by external organizations should be evaluated to ensure that it meets the needs for the job and that its quality is consistent with the standards of the operating organization.~~

QUALITY ASSURANCE SERVICES

~~7.11.7.12. Consideration should be given to the supporting services needed by~~

the plant management to meet the recommendations of IAEA Safety Series No. 50-C/SG-Q: Quality Assurance for Safety in Nuclear Power Plants and Other Nuclear Installations [8].

~~7.12.7.13.~~ The following activities should be undertaken in order to assist the plant management in obtaining uniformity of safety standards:

- ~~— assessing manufacturers' systems for the application of quality assurance at the plant;~~
- ~~— assessing the equipment being provided for nuclear power plant modification;~~
- ~~— ensuring that equipment delivered is of the specified quality;~~
- ~~— providing a pre commissioning inspection service for new systems and new equipment installed on the site;~~
- ~~— arranging for training and, where appropriate, certifying the competence of personnel for specialized crafts and inspection techniques;~~
- ~~— developing and maintaining quality standards, common purchasing specifications and classification codes for systems, components and materials;~~
- ~~— verifying that the quality assurance programme has been implemented satisfactorily, which should include verifying co-ordination of on-site and off-site activities; and~~
- ~~— making available suitably qualified staff to undertake the safety analysis and review activities mentioned in paras 6.46–6.50.~~

For an operating organization which controls more than one nuclear power plant, these activities may be performed by centralized services.

~~7.13.7.14.~~ Special arrangements should be made for commissioning and operational records, including their long term storage in accordance with the specifications provided in Ref. [8], Safety Guide Q3. Consideration should be given to the services needed for modernization of the documentation and records control system on the basis of advanced computer techniques.

RADIATION PROTECTION SERVICES

~~7.14.7.15.~~ The requirements and recommendations for radiation protection and radioactive waste management in a nuclear power plant are established in Refs [17, 18]. The extent to which these services should be augmented from off site resources should be considered. As a minimum, suitably qualified personnel should be made available to carry out an independent review of the activities of radiological services provided at the plant.

~~7.15.7.16. Appropriate specialist services should be provided to give advice and technical support on:~~

- ~~— specification of radiological laboratories for monitoring personnel and the environment;~~
- ~~— radiological aspects of commissioning and operation, including emergency arrangements;~~
- ~~— evaluation of operating experience in the radiological area;~~
- ~~— radiological aspects of plant modifications;~~
- ~~— development of techniques and equipment to reduce personnel doses; and~~
- ~~— compliance with statutory requirements and methods of ensuring satisfactory evidence of compliance with these requirements in relation to: authorization to discharge radioactive effluents, transport of radioactive material and on-site management of contaminated waste (e.g. by incineration).~~

~~7.16.7.17. The operating organization, which is responsible for a number of plants and which utilizes mobile teams of personnel for certain functions, should control individual~~

~~exposure using a central record keeping system. Similar requirements should be applied if services of contractors or other outside agencies are utilized extensively.~~

~~7.17.7.18. Suitable medical advice and appropriate bioassay facilities should be made available so that appropriate medical examinations of personnel employed in the process can be performed and advice on specific radiological medical problems can be provided. Stand-by provision of hospital services should be arranged to cover the possibility that medical assistance involving radiological factors may be required. The operating organization should utilize the services of a physician who has undergone specialized training and who is authorized by the competent authority to advise on and supervise the medical examinations and treatment of any person involved in a radiation accident.~~

~~MAINTENANCE, SURVEILLANCE AND IN-SERVICE INSPECTION SERVICES~~

~~7.18.7.19. A routine maintenance service should be provided to meet the requirements of the maintenance schedule, maintenance instructions and the surveillance programme. Maintenance services should provide the expertise for the independent assessment of maintenance aspects of new designs and of plant modifications during service. The extent to which this is provided from on-site or off-site sources is largely a matter of the operating organization's policy. However, the personnel of any maintenance team should possess the required standard of~~

skills and should receive the appropriate training in radiation protection and quality assurance.

~~7.19.7.20. If the central off-site workshop is used for maintenance of large components, the operating organization should ensure that the same quality assurance requirements are applied at such a facility as at the nuclear power plants. Reactor components shipped to a central facility may need more stringent standards of decontamination and, when such components are dismantled, appropriate off-site radiological controls should be provided.~~

~~7.20.7.21. The surveillance programme may require the provision of a service for calibrating instruments in accordance with the details given in Ref. [12].~~

~~7.21.7.22. As the in-service inspection workload tends to be of a periodic nature, this service may be provided either centrally or by outside agencies. If uniform standards are to be achieved to the satisfaction of the plant management and the regulatory body, then any non-destructive testing should be accompanied by the most meticulous specification of the tasks, appropriate training of staff and careful calibration of~~

~~equipment. Consideration should also be given to achieving uniformity in pre-service and in-service inspection standards.~~

~~7.22.7.23. When deciding whether special equipment for inspecting primary coolant boundary and reactor internals should be retained on the site or provided from sources off the site, due consideration should be given to the decontamination requirements for off-site transport.~~

~~7.23.7.24. Qualification services for in-service inspection systems may be required to verify that a proposed non-destructive testing method, technique or procedure and associated equipment are adequate for their purpose and that the inspection personnel is able to perform the assigned inspection duties. Any organization providing qualification services should be independent from any commercial or operational consideration. If the qualification bodies are part of the operating organization, they should satisfy specific independence criteria equivalent to those laid down in the appropriate international standards (e.g. EN 45004 for a type B inspection body).~~

~~7.24.7.25. Arrangements should also be made in order for services and facilities to maintain an appropriate and adequate inventory of stores and consumables, particularly items important to safety. Storage facilities should comply with requirements for quality assurance and environmental qualification (see Ref. [8], Safety Guide Q13).~~

~~7.25.7.26.~~ The planning of generation and transmission outages should be co-ordinated to ensure diversity of electrical supplies on the site and to satisfy the special safety requirements of a nuclear power plant. In addition, the load dispatch control of the system in which the nuclear power plant operates should conform to an operational regime for the plant that takes into account any restrictions on startup and rate of loading that arise from fuel or temperature limitations.

8. COMMUNICATION AND LIAISON

COMMUNICATION

8.1. Management of the operating organization at all levels should encourage and cultivate effective communication. Downward communication should provide assurance that management's direction and expectations are understood; upward communication should help encourage the identification of problems directly to management; horizontal communication should support effective work co-ordination and collaboration.

~~8.2.~~ An effective communication system/communication strategy should be in place in order to explain safety policy and implement an effective management system. There needs to be good open communication about safety throughout the organization. Individuals should be led to understand and accept why particular standards of safety are required. ~~CA~~ communication system can be either formal or informal, depending on the importance of the information provided. ~~An effective~~ good communication system should be in place to reinforce teamwork. In particular, there should be communication between shifts both in normal operation and in emergencies. Horizontal communication should be reinforced to encourage open lines of communication between interacting groups that work together to perform specific functions.

8.2.A Communications personnel should be trained professionals and should have direct access and ongoing interactions with senior management.

~~8.2.8.3.~~ Appropriate arrangements should be established to promote feedback from individuals on safety concerns. These could include both formal mechanisms such as safety meetings and informal mechanisms such as feedback to line managers. The organization should be open and responsive to feedback received from individuals, to avoid inhibiting effective communication. Management should be responsive to constructive criticism and feedback from the plant staff.

8.4. In addition to good communications within the organization, good communications should be established with outside organizations. In particular, there should be well defined and open routes of communication with regulatory bodies (see

also paragraphs 4.1–4.4). Outside communication should also recognize the broader social framework within which the organization operates, including the maintenance of a constructive dialogue with trade unions and other groups affected by the activities of the operating organization and their representatives.

8.4.A The operating organization should establish mechanisms to outreach to external entities.

8.3.8.5. Appropriate arrangements should be in place to monitor the effectiveness of internal and external communications and to act promptly to eliminate identified weaknesses.

8.4.8.6. To meet the management objectives and to discharge the responsibilities given in Section 3, an appropriate system of information flow should be established between participating organizations. Particular attention should be placed on establishing channels to ensure that:

- general safety principles and policies relevant to operation are taken into account in the design, construction, commissioning and operation stages, including decommissioning;
- there is adequate feedback of operation, maintenance and surveillance experience, particularly to design and operating personnel;
- requisite information is provided to the regulatory body and arrangements are made for appropriate dissemination of its requirements within the operating organization.

8.6.B The operating organization should develop and periodically review its crisis communication plan and public communication should be incorporated into the overall emergency response plan. See also Ref.[20].

LIAISON

8.5.8.7. An operating organization should ensure that an appropriate liaison is established between all parties involved in the design, construction, commissioning and operation of a nuclear power plant.

8.6.8.8. Arrangements should be made for the participation of operating organization personnel in the design and design review processes early in the design stage. These arrangements should enable the operating organization personnel to make a contribution to improvements in the plant design by way of feedback of operating experience. At the same time they should provide an opportunity for the personnel to acquire a knowledge in depth of the plant design and a thorough understanding of the

operational limits and conditions for operation. The operating personnel should be given the opportunity to consider the following:

- (1) the adequacy and redundancy of systems and components to meet operational limits and conditions and other operational requirements;
- (2) the general layout as regards the convenience and efficiency of operation, particularly in relation to contamination control and to keeping doses ALARA;
- (3) ergonomic aspects, especially to provide for rapid assessment of plant conditions, proper operator response and prevention of inadvertent actions;
- (4) the extent of automatic control;
- (5) specifications concerning components, and instrumentation for operational states and accident conditions;
- (6) radioactive waste handling and disposal, including provision for post-accident conditions;
- (7) the type and number of spare parts, taking account of procurement times;
- (8) provision of special tooling necessary for repairs and inspection;
- (9) requirements for maintenance, surveillance and in-service inspection, including access to and availability of equipment and facilities;
- (10) radiation protection arrangements to fulfil the ALARA principle and statutory requirements;
- (11) assessment of on-site and off-site consequences of postulated accident conditions and post-accident conditions.

8.7.8.9. The construction phase can provide experience and useful information for future operational activities, including maintenance and surveillance. Therefore, the operating organization should arrange for the involvement of its staff, particularly of its maintenance personnel, in construction activities so that they undergo hands-on training in complex operations requiring special skills. This participation may not only help in detecting any discrepancies between approved specifications and the methods and techniques actually used during construction before they can endanger safety, but it should also assist in the development of operating and maintenance instructions and in the transfer of all requisite 'as built' documentation.

8.8.8.10. Although operating personnel generally participate in the operation of the plant during the commissioning period, it is advantageous for them to have more direct involvement in commissioning. The operating organization should consider the advantages of its operating personnel participating in test preparation and performance and evaluation of test results, as this would enable them to validate the operating procedures and at the same time to obtain the preliminary operating experience needed to facilitate the transfer of responsibilities from the commissioning to the operating groups. Such participation may vary from the setting up of mixed testing teams (supplier/operating personnel) to the complete involvement of the operating organization in a given test, according to the operating organization's policy. Detailed recommendations and guidance on the involvement of operating

personnel in testing are given in Ref.[10].

8.9.8.11. Liaison during the operational stage should be established to provide feedback of experience to the various groups in the operating organization, design organization, architect/engineer organization, research services and the regulatory body, as appropriate. This liaison should thereby lead to improvements in the operational aspects of design, in the operating procedures and in the planning of research programmes so that they are relevant to the operational needs of the plant. This system should also ensure the collection and evaluation of information from other operating plants on any unresolved safety questions, maintenance problems, incident and accident conditions, and component and system behaviour. Such a system should include the use of national or international information services such as data banks.

CONTINUOUS IMPROVEMENT

Inputs description:

Performance improvement is comprised of a set of tools that accomplish ~~the key attributes noted above~~ and drive continuous improvement. ~~(see Figure 1).~~ These tools consist of the Corrective Action Programme (CAP), ~~sSelf-a~~Assessment and ~~bBenchmarking- programmes~~, the ~~oOperating eExperience pProgramme~~, ~~oObservation pProgramme~~, ~~pPerformance aAssessment~~ and ~~trending~~, and ~~pperformance iindicators~~. Insights from the ~~iIndependent oOversight~~ organization, ~~sSafety cCommittees, regulators~~, and external organizations such as IAEA, WANO, ~~and the regulator~~ also provide input to continuous improvement. Collectively this provides the means in which the organization assesses performance and drives continuous improvement on ongoing bases.

1. Corrective Action Programme (CAP)

The general objective of CAP is to identify, document, evaluate, and trend issues and to develop and implement appropriate actions to correct identified issues. CAP is formal, rigorous and requirements are strictly defined to assure important issues are thoroughly resolved. (Ref.[8] Requirement 13).

2. Operating Experience

The Operating Experience (OE) programme is designed to effectively and efficiently use lessons learned from internal and external operating experience to improve plant safety and reliability, through learning, training and improving procedures. (Ref.[1] Requirement 24).

3. Observation programme

Observations of daily work activities influence culture, both routine and unscheduled. Managers, supervisors, and individuals should value observations because they generate feedback that sharpens work habits and provide opportunities to detect and prevent problems.

By completing observations, managers, supervisors and individuals see firsthand what is happening in the plant. The quality of individual performance and supervision, the adherence to standards and expectations, the effectiveness of administrative processes, procedures, and training, as well as the materiel condition and the strength of the

organization's values and safety culture require continual scrutiny. Observations provide the ability to gauge the effectiveness of the organization's performance improvement efforts- (Ref.[1] Requirement 9).

4. Self-Assessment

Self-assessments ~~is~~are a proactive way of comparing existing performance to established standards to determine areas in need of improvement.

The intent of the ~~sSelf-aAssessment pProgramme~~ is to identify gaps ~~to world-class excellence~~. During self-assessments current performance is compared to management expectations, industry excellence, and regulatory requirements to identify strengths, weaknesses, and improvement opportunities- (Ref.[1] Requirement 9).

5. Performance Assessment & Trending

Performance assessment and trending are proactive analysis activities that lead to the identification of performance gaps before they reveal themselves. As such, an organization should be able to fix a problem before the problem becomes self-revealing through a consequential event or significant organizational breakdown.

Performance assessment and trending involves the collective analysis of information obtained from the wide spectrum of performance monitoring activities. Performance assessment finds performance gaps, creates or adjusts action plans, and develops organizational alignment and understanding. The most visible outcome is an organizational focus on the top gaps to excellence that, if addressed effectively, will make the most impact on performance- (Ref.[1] Requirement 24).

6. Performance Indicators

A set of measurable and objective indicators representing safety performance should be identified to establish performance goals and ~~so~~ enable senior managers to identify degraded performance and/or declining trends, ~~and~~ to analyze the situation and then act to improve performance- (Ref.[1] Requirement 9).

7. Benchmarking

Organizations should use internal and external benchmarking to identify potential improvements around identified gaps in performance.

Benchmarking is conducted to ensure organizations do not become isolated but stay connected to the rest of the industry. Seeking and drawing from the experience and good practices of other organizations that are achieving success, both within and outside the nuclear industry. Very few problems are unique to one organization and other businesses

have more than likely addressed and resolved the problem at their facilities. (Ref.[8B] Section 3.30).

8. Independent Safety Oversight

Independent safety oversight assesses and reports on the safety-management for safety system through formal audits, surveillance, independent technical reviews, and quality control inspections. Independent safety oversight enhances safety through its influence on the behavior of the organization by performing the following:

1. Verify nuclear safety standards and regulatory requirements are met.
2. Advise senior management on the status of performance, significant performance trends, and the principal challenges to performance.
3. Consult management as requested to provide independent reviews and insights.
4. Perform independent assessments of performance issues that are important to safety.

Performance information from independent safety oversight is used to provide senior managers with an independent view of performance and is routinely analyzed to identify issues for increased management attention. (Ref.[8] Requirement 13).

9. Nuclear Safety Committee

A Nuclear Safety Committee (sometimes referred to as Nuclear Safety Review Board) is providing an independent review of performance and activities that relate to the safe operation of nuclear plants. Nuclear Safety Committees are comprised of executives, senior managers, and consultants with extensive nuclear industry experience.

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GLOSSARY

commissioning. The process during which systems and components of a nuclear power plant, having been constructed, are made operational and verified to be in accordance with design and to have met the required performance criteria. Commissioning may include both non nuclear and nuclear testing.

operating organization. The organization authorized by the regulatory body to operate a facility.

operation. All activities performed to achieve the purpose for which a facility was constructed. For a nuclear power plant, this includes maintenance, refuelling, in-service inspection and other associated activities.

operational limits and conditions. A set of rules setting forth parameter limits, the functional capability and the performance levels of equipment and personnel approved by the regulatory body for safe operation of an authorized facility.

plant states

operational states			accident conditions		
			beyond design basis accidents		
			design basis accidents		
anticipated operational occurrences					
normal operation			(a)	accidents	(b) accidents
			accident management		

(a): Accident conditions which are not explicitly considered design basis accidents but are encompassed by them.

(b): Beyond design basis accidents without significant core degradation.

accident conditions. Deviations from normal operation more severe than anticipated operational occurrences, including design basis accidents and severe accidents.

accident management. The taking of a set of actions during the evolution of a beyond design basis accident.

- to prevent the escalation of the event into a severe accident;
- to mitigate the consequences of a severe accident; and
- to achieve a long term safe stable state.

anticipated operational occurrence. An operational process deviating from normal operation which is expected to occur at least once during the operating lifetime of a facility but which, in view of appropriate design provisions, does not cause any significant damage to items important to safety or lead to accident conditions.

design basis accident. Accident conditions against which a nuclear power plant is designed according to established design criteria, and for which the damage to the fuel and the release of radioactive material are kept within authorized limits.

normal operation. Operation within specified operational limits and conditions.

operational states. States defined under normal operation and anticipated operational occurrences.

severe accident. Accident conditions more severe than a design basis accident and involving significant core degradation.

regulatory body. An authority or a system of authorities designated by the government of a State as having legal authority for conducting the regulatory process, including issuing authorizations, and thereby regulating nuclear, radiation, radioactive waste and transport safety. The national competent authority for the regulation of radioactive material transport safety is included in this description, as is the Regulatory Authority for radiation protection and safety.

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