

IAEA Safety Standards

for protecting people and the environment

Commissioning of Research Reactors

Specific Safety Guide

No. SSG-80



IAEA

International Atomic Energy Agency



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IAEA SAFETY STANDARDS

Under the terms of Article III of its Statute, the IAEA is authorized to establish or adopt standards of safety for protection of health and minimization of danger to life and property, and to provide for the application of these standards.

The publications by means of which the IAEA establishes standards are issued in the **IAEA Safety Standards Series**. This series covers nuclear safety, radiation safety, transport safety and waste safety. The publication categories in the series are **Safety Fundamentals**, **Safety Requirements** and **Safety Guides**.

Information on the IAEA's safety standards programme is available on the IAEA Internet site

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The site provides the texts in English of published and draft safety standards. The texts of safety standards issued in Arabic, Chinese, French, Russian and Spanish, the IAEA Safety Glossary and a status report for safety standards under development are also available. For further information, please contact the IAEA at: Vienna International Centre, PO Box 100, 1400 Vienna, Austria.

All users of IAEA safety standards are invited to inform the IAEA of experience in their use (e.g. as a basis for national regulations, for safety reviews and for training courses) for the purpose of ensuring that they continue to meet users' needs. Information may be provided via the IAEA Internet site or by post, as above, or by email to Official.Mail@iaea.org.

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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".

IAEA SAFETY STANDARDS SERIES No. SSG-80

COMMISSIONING OF RESEARCH REACTORS

SPECIFIC SAFETY GUIDE

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2023

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FOREWORD

by Rafael Mariano Grossi
Director General

The IAEA's Statute authorizes it to "establish...standards of safety for protection of health and minimization of danger to life and property". These are standards that the IAEA must apply to its own operations, and that States can apply through their national regulations.

The IAEA started its safety standards programme in 1958 and there have been many developments since. As Director General, I am committed to ensuring that the IAEA maintains and improves upon this integrated, comprehensive and consistent set of up to date, user friendly and fit for purpose safety standards of high quality. Their proper application in the use of nuclear science and technology should offer a high level of protection for people and the environment across the world and provide the confidence necessary to allow for the ongoing use of nuclear technology for the benefit of all.

Safety is a national responsibility underpinned by a number of international conventions. The IAEA safety standards form a basis for these legal instruments and serve as a global reference to help parties meet their obligations. While safety standards are not legally binding on Member States, they are widely applied. They have become an indispensable reference point and a common denominator for the vast majority of Member States that have adopted these standards for use in national regulations to enhance safety in nuclear power generation, research reactors and fuel cycle facilities as well as in nuclear applications in medicine, industry, agriculture and research.

The IAEA safety standards are based on the practical experience of its Member States and produced through international consensus. The involvement of the members of the Safety Standards Committees, the Nuclear Security Guidance Committee and the Commission on Safety Standards is particularly important, and I am grateful to all those who contribute their knowledge and expertise to this endeavour.

The IAEA also uses these safety standards when it assists Member States through its review missions and advisory services. This helps Member States in the application of the standards and enables valuable experience and insight to be shared. Feedback from these missions and services, and lessons identified from events and experience in the use and application of the safety standards, are taken into account during their periodic revision.

I believe the IAEA safety standards and their application make an invaluable contribution to ensuring a high level of safety in the use of nuclear technology. I encourage all Member States to promote and apply these standards, and to work with the IAEA to uphold their quality now and in the future.

THE IAEA SAFETY STANDARDS

BACKGROUND

Radioactivity is a natural phenomenon and natural sources of radiation are features of the environment. Radiation and radioactive substances have many beneficial applications, ranging from power generation to uses in medicine, industry and agriculture. The radiation risks to workers and the public and to the environment that may arise from these applications have to be assessed and, if necessary, controlled.

Activities such as the medical uses of radiation, the operation of nuclear installations, the production, transport and use of radioactive material, and the management of radioactive waste must therefore be subject to standards of safety.

Regulating safety is a national responsibility. However, radiation risks may transcend national borders, and international cooperation serves to promote and enhance safety globally by exchanging experience and by improving capabilities to control hazards, to prevent accidents, to respond to emergencies and to mitigate any harmful consequences.

States have an obligation of diligence and duty of care, and are expected to fulfil their national and international undertakings and obligations.

International safety standards provide support for States in meeting their obligations under general principles of international law, such as those relating to environmental protection. International safety standards also promote and assure confidence in safety and facilitate international commerce and trade.

A global nuclear safety regime is in place and is being continuously improved. IAEA safety standards, which support the implementation of binding international instruments and national safety infrastructures, are a cornerstone of this global regime. The IAEA safety standards constitute a useful tool for contracting parties to assess their performance under these international conventions.

THE IAEA SAFETY STANDARDS

The status of the IAEA safety standards derives from the IAEA's Statute, which authorizes the IAEA to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property, and to provide for their application.

With a view to ensuring the protection of people and the environment from harmful effects of ionizing radiation, the IAEA safety standards establish fundamental safety principles, requirements and measures to control the radiation exposure of people and the release of radioactive material to the environment, to restrict the likelihood of events that might lead to a loss of control over a nuclear reactor core, nuclear chain reaction, radioactive source or any other source of radiation, and to mitigate the consequences of such events if they were to occur. The standards apply to facilities and activities that give rise to radiation risks, including nuclear installations, the use of radiation and radioactive sources, the transport of radioactive material and the management of radioactive waste.

Safety measures and security measures¹ have in common the aim of protecting human life and health and the environment. Safety measures and security measures must be designed and implemented in an integrated manner so that security measures do not compromise safety and safety measures do not compromise security.

The IAEA safety standards reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation. They are issued in the IAEA Safety Standards Series, which has three categories (see Fig. 1).

Safety Fundamentals

Safety Fundamentals present the fundamental safety objective and principles of protection and safety, and provide the basis for the safety requirements.

Safety Requirements

An integrated and consistent set of Safety Requirements establishes the requirements that must be met to ensure the protection of people and the environment, both now and in the future. The requirements are governed by the objective and principles of the Safety Fundamentals. If the requirements are not met, measures must be taken to reach or restore the required level of safety. The format and style of the requirements facilitate their use for the establishment, in a harmonized manner, of a national regulatory framework. Requirements, including numbered ‘overarching’ requirements, are expressed as ‘shall’ statements. Many requirements are not addressed to a specific party, the implication being that the appropriate parties are responsible for fulfilling them.

Safety Guides

Safety Guides provide recommendations and guidance on how to comply with the safety requirements, indicating an international consensus that it

¹ See also publications issued in the IAEA Nuclear Security Series.

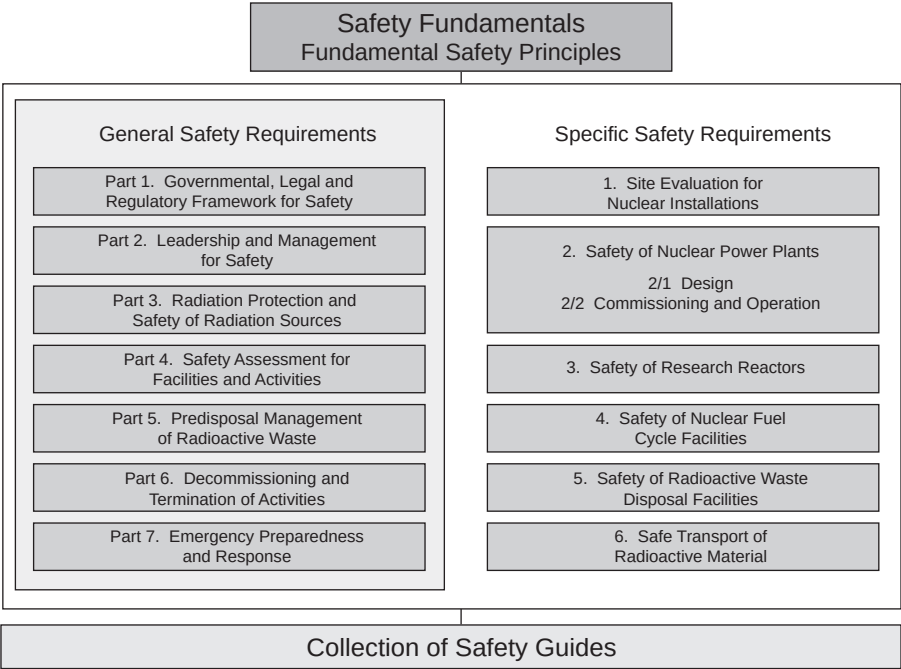


FIG. 1. The long term structure of the IAEA Safety Standards Series.

is necessary to take the measures recommended (or equivalent alternative measures). The Safety Guides present international good practices, and increasingly they reflect best practices, to help users striving to achieve high levels of safety. The recommendations provided in Safety Guides are expressed as ‘should’ statements.

APPLICATION OF THE IAEA SAFETY STANDARDS

The principal users of safety standards in IAEA Member States are regulatory bodies and other relevant national authorities. The IAEA safety standards are also used by co-sponsoring organizations and by many organizations that design, construct and operate nuclear facilities, as well as organizations involved in the use of radiation and radioactive sources.

The IAEA safety standards are applicable, as relevant, throughout the entire lifetime of all facilities and activities — existing and new — utilized for peaceful purposes and to protective actions to reduce existing radiation risks. They can be

used by States as a reference for their national regulations in respect of facilities and activities.

The IAEA's Statute makes the safety standards binding on the IAEA in relation to its own operations and also on States in relation to IAEA assisted operations.

The IAEA safety standards also form the basis for the IAEA's safety review services, and they are used by the IAEA in support of competence building, including the development of educational curricula and training courses.

International conventions contain requirements similar to those in the IAEA safety standards and make them binding on contracting parties. The IAEA safety standards, supplemented by international conventions, industry standards and detailed national requirements, establish a consistent basis for protecting people and the environment. There will also be some special aspects of safety that need to be assessed at the national level. For example, many of the IAEA safety standards, in particular those addressing aspects of safety in planning or design, are intended to apply primarily to new facilities and activities. The requirements established in the IAEA safety standards might not be fully met at some existing facilities that were built to earlier standards. The way in which IAEA safety standards are to be applied to such facilities is a decision for individual States.

The scientific considerations underlying the IAEA safety standards provide an objective basis for decisions concerning safety; however, decision makers must also make informed judgements and must determine how best to balance the benefits of an action or an activity against the associated radiation risks and any other detrimental impacts to which it gives rise.

DEVELOPMENT PROCESS FOR THE IAEA SAFETY STANDARDS

The preparation and review of the safety standards involves the IAEA Secretariat and five Safety Standards Committees, for emergency preparedness and response (EPReSC) (as of 2016), nuclear safety (NUSSC), radiation safety (RASSC), the safety of radioactive waste (WASSC) and the safe transport of radioactive material (TRANSSC), and a Commission on Safety Standards (CSS) which oversees the IAEA safety standards programme (see Fig. 2).

All IAEA Member States may nominate experts for the Safety Standards Committees and may provide comments on draft standards. The membership of the Commission on Safety Standards is appointed by the Director General and includes senior governmental officials having responsibility for establishing national standards.

A management system has been established for the processes of planning, developing, reviewing, revising and establishing the IAEA safety standards.

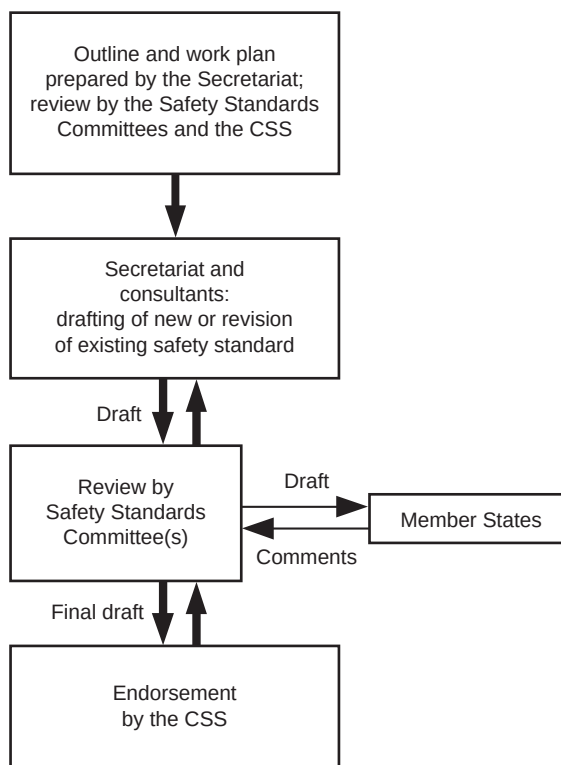


FIG. 2. The process for developing a new safety standard or revising an existing standard.

It articulates the mandate of the IAEA, the vision for the future application of the safety standards, policies and strategies, and corresponding functions and responsibilities.

INTERACTION WITH OTHER INTERNATIONAL ORGANIZATIONS

The findings of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the recommendations of international expert bodies, notably the International Commission on Radiological Protection (ICRP), are taken into account in developing the IAEA safety standards. Some safety standards are developed in cooperation with other bodies in the United Nations system or other specialized agencies, including the Food and Agriculture Organization of the United Nations, the United Nations Environment Programme, the International Labour Organization, the OECD Nuclear Energy Agency, the Pan American Health Organization and the World Health Organization.

INTERPRETATION OF THE TEXT

Safety related terms are to be understood as defined in the IAEA Nuclear Safety and Security Glossary (see <https://www.iaea.org/resources/publications/iaea-nuclear-safety-and-security-glossary>). Otherwise, words are used with the spellings and meanings assigned to them in the latest edition of The Concise Oxford Dictionary. For Safety Guides, the English version of the text is the authoritative version.

The background and context of each standard in the IAEA Safety Standards Series and its objective, scope and structure are explained in Section 1, Introduction, of each publication.

Material for which there is no appropriate place in the body text (e.g. material that is subsidiary to or separate from the body text, is included in support of statements in the body text, or describes methods of calculation, procedures or limits and conditions) may be presented in appendices or annexes.

An appendix, if included, is considered to form an integral part of the safety standard. Material in an appendix has the same status as the body text, and the IAEA assumes authorship of it. Annexes and footnotes to the main text, if included, are used to provide practical examples or additional information or explanation. Annexes and footnotes are not integral parts of the main text. Annex material published by the IAEA is not necessarily issued under its authorship; material under other authorship may be presented in annexes to the safety standards. Extraneous material presented in annexes is excerpted and adapted as necessary to be generally useful.

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1. INTRODUCTION

BACKGROUND

1.1. Requirements for the safety of research reactors, with particular emphasis on their design and operation, are established in IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors [1].

1.2. This Safety Guide provides recommendations on the commissioning of research reactors, both the commissioning of reactor modifications and experiments and the commissioning of the reactor itself.

1.3. This Safety Guide was developed in parallel with seven other Safety Guides on the safety of research reactors, as follows:

- (a) IAEA Safety Standards Series No. SSG-81, Maintenance, Periodic Testing and Inspection of Research Reactors [2];
- (b) IAEA Safety Standards Series No. SSG-82, Core Management and Fuel Handling for Research Reactors [3];
- (c) IAEA Safety Standards Series No. SSG-83, Operational Limits and Conditions and Operating Procedures for Research Reactors [4];
- (d) IAEA Safety Standards Series No. SSG-84, The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors [5];
- (e) IAEA Safety Standards Series No. SSG-85, Radiation Protection and Radioactive Waste Management in the Design and Operation of Research Reactors [6];
- (f) IAEA Safety Standards Series No. SSG-10 (Rev. 1), Ageing Management for Research Reactors [7];
- (g) IAEA Safety Standards Series No. SSG-37 (Rev. 1), Instrumentation and Control Systems and Software Important to Safety for Research Reactors [8].

1.4. Additional recommendations on the safety of research reactors are provided in IAEA Safety Standards Series Nos SSG-20 (Rev. 1), Safety Assessment for Research Reactors and Preparation of the Safety Analysis Report [9], and SSG-24 (Rev. 1), Safety in the Utilization and Modification of Research Reactors [10].

1.5. The terms used in this Safety Guide are to be understood as defined and explained in the IAEA Nuclear Safety and Security Glossary [11].

1.6. This Safety Guide supersedes IAEA Safety Standards Series No. NS-G-4.1, Commissioning of Research Reactors¹.

OBJECTIVE

1.7. The objective of this Safety Guide is to provide recommendations on the commissioning of research reactors to meet the relevant requirements established in SSR-3 [1], in particular Requirements 30 and 73.

1.8. The recommendations provided in this Safety Guide are aimed at operating organizations of research reactors, regulatory bodies and other organizations involved in a research reactor project.

SCOPE

1.9. This Safety Guide is primarily intended for use for heterogeneous, thermal spectrum research reactors that have a power rating of up to several tens of megawatts. For research reactors of higher power, specialized reactors (e.g. fast spectrum reactors) and reactors that have specialized facilities (e.g. hot or cold neutron sources, high pressure and high temperature loops), additional guidance may be needed. For such research reactors, the recommendations provided in IAEA Safety Standards Series No. SSG-28, Commissioning for Nuclear Power Plants [12], might be more suitable. Homogeneous reactors and accelerator driven systems are outside the scope of this publication.

1.10. Some research reactors, critical assemblies and subcritical assemblies with a low hazard potential might need a less comprehensive commissioning programme. While all recommendations in this Safety Guide are to be considered, some might not be applicable to such research reactors, critical assemblies and subcritical assemblies (see Requirement 12 and paras 2.15–2.17 of SSR-3 [1], as well as IAEA Safety Standards Series No. SSG-22 (Rev. 1), Use of a Graded Approach in the Application of the Safety Requirements for Research Reactors [13]).

1.11. In this Safety Guide, subcritical assemblies will be mentioned separately only if a specific recommendation is not relevant for, or is applicable only to, subcritical assemblies.

¹ INTERNATIONAL ATOMIC ENERGY AGENCY, Commissioning of Research Reactors, IAEA Safety Standards Series No. NS-G-4.1, IAEA, Vienna (2006).

1.12. Although this Safety Guide is primarily intended for the commissioning of newly designed and constructed reactors, it is also suitable for the recommissioning of a research reactor (e.g. after a period of extended shutdown) and for the commissioning of new experimental devices and reactor modifications.

1.13. Additional guidance may be useful for certain modifications. In particular, recommendations on the commissioning of new digital systems are provided in SSG-37 (Rev. 1) [8].

STRUCTURE

1.14. Sections 2 and 3 provide recommendations on the management system for commissioning and on the commissioning programme, respectively. Section 3 includes general recommendations for the commissioning process and, in particular, for the preparation and review of the commissioning programme. Section 4 provides recommendations on the organization for commissioning and the management of commissioning and establishes the responsibilities and functions of the organizations and groups involved, including interfaces between groups and handover activities. Section 5 describes the general considerations, tests and prerequisites for the different stages of the commissioning programme. Reference to the Appendix is made when describing the tests and prerequisites for each stage. Section 6 covers preparation of the commissioning procedures and reporting of the results and conclusions of commissioning. Section 7 provides recommendations on keeping the commissioning records and updating the safety documentation to take into account the results of commissioning. Section 8 deals with the commissioning of new experimental devices, experiments and reactor modifications. The Appendix provides a comprehensive list of prerequisites and tests that are usually included in the commissioning programme for a research reactor.

2. APPLICATION OF THE MANAGEMENT SYSTEM TO THE COMMISSIONING OF A RESEARCH REACTOR

2.1. A management system that integrates safety, health, environmental, security, quality, human-and-organizational-factor, societal and economic elements for the research reactor project is required to be developed (see Requirement 4 of SSR-3 [1]). The documentation of the management system should describe the

system that controls the planning and implementation of all activities at the research reactor, including the development and implementation of the commissioning process. Approval of the management system (or parts thereof) by the regulatory body may be required (see para. 4.12 of SSR-3 [1]).

2.2. In accordance with paras 4.13–4.20 of SSR-3 [1], the management system is required to cover four functional categories, as follows:

- (a) Management responsibility: includes providing the means and management support needed to achieve the organization's objectives (see para. 2.14 of this Safety Guide).
- (b) Resource management: includes the measures needed to ensure that resources essential to the implementation of strategy and the achievement of the organization's objectives are identified and made available (see paras 2.15–2.18 of this Safety Guide).
- (c) Process implementation: includes those actions and tasks needed to achieve the goals of the organization (see paras 2.19–2.24 of this Safety Guide).
- (d) Measurement, assessment and improvement of the management system: includes activities conducted to evaluate the effectiveness of management processes and work performance (see paras 2.25–2.31 of this Safety Guide).

General requirements for the management system are established in IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety [14]. Specific recommendations are provided in IAEA Safety Standards Series No. GS-G-3.5, The Management System for Nuclear Installations [15].

2.3. As part of the management system, the arrangements for the management of the commissioning of the research reactor should be established and implemented by the operating organization early in the planning for commissioning. These arrangements should apply to the commissioning of all items, services and processes important to safety and should include the means of establishing controls over commissioning activities. This should provide confidence that commissioning is performed in accordance with established codes, standards, specifications, procedures and administrative controls, as required by para. 4.16 of SSR-3 [1].

2.4. In establishing the management system, a graded approach in accordance with the relative importance to safety of each item or process is required to be used (see para. 4.7 of SSR-3 [1]).

2.5. The objective of the management system as applied to commissioning should be to ensure that the facility meets the following:

- (a) Regulatory requirements;
- (b) Design requirements and assumptions;
- (c) The safety analysis report (see Requirement 1 of SSR-3 [1]);
- (d) The operational limits and conditions (OLCs) for the research reactor (see Requirement 71 of SSR-3 [1]);
- (e) Administrative requirements associated with the management of the research reactor.

2.6. The management system is required to support the development, implementation and enhancement of a strong safety culture (see paras 1.5(b) and 4.9 of GSR Part 2 [14]). This safety culture should be applied in all aspects of the commissioning programme.

2.7. The management system should describe how commissioning work is to be managed, performed, documented and assessed. The documentation of the management system is required to include the organizational structure, functional responsibilities, levels of authority and interfaces for those managing, performing and assessing the adequacy of work (see para. 4.16 of GSR Part 2 [14]). The management system should also address planning and scheduling of commissioning activities, resource allocation (see Requirement 9 of GSR Part 2 [14] and para. 4.15 of SSR-3 [1]) and human factors.

2.8. The application of the management system to commissioning should be described in the commissioning programme and documented in procedures and instructions. These procedures and instructions should document both the commissioning activities and the performance and verification of specific commissioning activities. The relevant requirements of the management system are required to be communicated to the personnel in the commissioning organization (see para. 4.26 of GSR Part 2 [14]).

2.9. Requirement 11 of GSR Part 2 [14] states that **“The organization shall put in place arrangements with vendors, contractors and suppliers for specifying, monitoring and managing the supply to it of items, products and services that may influence safety.”** Methods of control should be adopted to ensure that procured items and services meet the relevant requirements of the management system and perform as specified. This may involve the development of specifications for items to be procured, the evaluation of vendors and suppliers, and inspections or tests.

2.10. Commissioning activities should be performed and recorded in accordance with the procedures and instructions documented in the management system.

2.11. The commissioning programme should include the following:

- (a) Planning and prioritizing work;
- (b) Addressing regulatory requirements;
- (c) Ensuring compliance with the OLCs;
- (d) Ensuring the availability of sufficient qualified personnel with suitable skills;
- (e) Implementing appropriate procedures and instructions, including those for assessing and correcting non-conforming items;
- (f) Ensuring the availability of special instruments and equipment;
- (g) Ensuring a satisfactory working environment, including suitable preparation of the workplace and suitable protection of workers;
- (h) Performing and documenting the necessary inspections and tests.

2.12. Documents essential to the performance and verification of commissioning activities (e.g. procedures, specifications, drawings) are required to be controlled (see Requirement 8 of GSR Part 2 [14]). In particular, measures should be established for the preparation, identification, review, validation, approval, issue, distribution, revision and archiving of such documents. These measures should apply to the following:

- (a) Design documents, and any changes and revisions;
- (b) Commissioning procedures, instructions and drawings, and any changes and revisions;
- (c) Documents on equipment control and maintenance;
- (d) Documentation pertaining to calibration and control of measuring and test equipment;
- (e) Commissioning records and results;
- (f) Other records essential to the performance and verification of commissioning activities.

2.13. Methods should be established to manage non-conformance (see para. 7.48 of SSR-3 [1]) and to implement corrective actions and changes. Items, services and processes that do not meet their specified performance requirements, including those that necessitate design changes, should be identified and reported to the appropriate level of management and should be corrected in accordance with the arrangements for approving concessions, corrective actions and preventive actions (see also para. 7.76 of SSR-3 [1]). To ensure improvement, the causes of

such non-conformance are required to be evaluated, and action is required to be taken to prevent their recurrence (see para. 6.3 of GSR Part 2 [14]).

MANAGEMENT RESPONSIBILITY FOR COMMISSIONING OF A RESEARCH REACTOR

2.14. In accordance with Requirement 2 of SSR-3 [1], the operating organization (licensee) has the prime responsibility for the safety of the research reactor during commissioning. In cases where commissioning activities have been assigned to another organization, the organization performing these activities should be accountable to the operating organization. The reactor management² should participate in the commissioning programme by means of the following:

- (a) Having frequent contact with organizations and groups involved in the commissioning, including overseeing of work in progress;
- (b) Establishing and implementing a set of performance indicators for commissioning;
- (c) Participating in evaluations of the commissioning programme;
- (d) Providing feedback derived from commissioning performance indicators for use in the operation of the research reactor.

RESOURCE MANAGEMENT FOR COMMISSIONING OF A RESEARCH REACTOR

2.15. In accordance with para. 7.28 of SSR-3 [1], the competence requirements for personnel performing commissioning work are required to be determined. Suitable training is required to be provided (see paras 7.28 and 7.29 of SSR-3 [1]) to ensure that personnel are competent to perform their assigned work.

2.16. External personnel (e.g. personnel employed by vendors and suppliers) who perform commissioning activities should be appropriately trained and qualified. Such personnel should be able to demonstrate proficiency or adequate prior qualifications, training and experience. Paragraph 4.15(b) of SSR-3 [1] states that “The management system shall ensure that: ...External personnel (including suppliers and experimenters) are adequately trained and qualified and

² The reactor management comprises members of the operating organization to whom the responsibility and the authority for directing the operation of the research reactor have been assigned.

perform their activities under the same controls and to the same standards as the reactor personnel”. Research reactor supervisors should review the work of such personnel during preparation for the work, during the work and during testing.

2.17. Vendors and suppliers should be evaluated and selected on the basis of specified criteria. Paragraph 4.15(a) of SSR-3 [1] states:

“The management system shall ensure that: ...Suppliers, manufacturers and designers of structures, systems and components important to safety have an effective integrated management system in place, with audits to confirm its effectiveness”.

Arrangements should be made with vendors and suppliers to ensure that the regulatory body is provided with any information it has requested.

2.18. Paragraph 4.15(c) of SSR-3 [1] states that “The management system shall ensure that: ...The equipment, tools, materials, hardware and software necessary to conduct the work in a safe manner are identified, provided, checked, and verified and maintained.” The equipment should be suitable for its intended use. Equipment used for monitoring, data collection, and inspections and tests should have a valid calibration certificate and should be appropriately documented.

PROCESS IMPLEMENTATION FOR COMMISSIONING OF A RESEARCH REACTOR

2.19. The activities and interfaces between different groups involved in commissioning should be planned, controlled and managed to ensure effective communication and the clear assignment of responsibility.

2.20. The operating organization should nominate a person to be responsible and accountable for developing and documenting the commissioning programme, monitoring the performance of the programme, ensuring that the operating personnel are competent, and evaluating the impact of the programme on safety. This person is usually the reactor manager (see paras 7.13–7.19 of SSR-3 [1]).

2.21. In accordance with para. 4.16 of SSR-3 [1], commissioning is required to be performed in accordance with established engineering codes, standards, specifications, procedures and administrative controls.

2.22. Inspection, testing, verification and validation activities should be completed before the implementation or operational use of structures, systems and components (SSCs).

2.23. Appropriate monitoring and measurement of SSCs should be performed to provide evidence of conformity to design requirements and satisfactory performance in service.

2.24. Paragraph 4.19 of SSR-3 [1] states that “Suppliers shall be evaluated and selected on the basis of specified criteria.” Such criteria should be developed and documented within the operating organization’s procurement process.

MEASUREMENT, ASSESSMENT AND IMPROVEMENT OF THE MANAGEMENT SYSTEM IN COMMISSIONING OF A RESEARCH REACTOR

2.25. Paragraph 4.20 of SSR-3 [1] states:

“The effectiveness of the management system shall be regularly measured and assessed through independent assessments and self-assessments. Weaknesses in processes shall be identified and corrected. The operating organization shall evaluate the results of such assessments and shall determine and take the necessary actions for continuous improvements.”

2.26. Suitable methods should be applied for monitoring the effectiveness of the commissioning programme. The methods should take into account the operational conditions expected during the operation and planned utilization of the research reactor.

2.27. Paragraph 7.54 of SSR-3 [1] states:

“The commissioning programme shall include provisions and procedures for audits, reviews and verifications intended to ensure that the programme has been conducted as planned and that its objectives have been fully achieved. Provisions shall also be included for resolving any deviation or deficiency that is discovered during the commissioning tests.”

2.28. An organizational unit should be established to conduct independent assessments of the commissioning programme. This organizational unit may be the reactor safety committee, as described in paras 7.26 and 7.27 of SSR-3 [1] and

in para. 4.18 of this Safety Guide. Further requirements on the management of independent assessments and self-assessments are established in GSR Part 2 [14], and further recommendations are provided in GS-G-3.5 [15].

2.29. Independent assessment measures, including review and verification, should be established to ensure that commissioning activities are performed as specified in the appropriate procedures. These measures may include the following:

- (a) Review of commissioning procedures;
- (b) Verification of commissioning activities by means of inspection, witnessing and surveillance;
- (c) Functional testing following maintenance, repair or modification;
- (d) Review and verification of commissioning records, results and reports, including those on the status of commissioning, non-conformance control and corrective actions.

2.30. Qualified personnel should perform the verification of commissioning activities; these personnel should not be directly responsible for the commissioning activities being verified.

2.31. The audits referred to in para. 2.27 should determine the adequacy and effectiveness of, and adherence to, all aspects of the management system during the commissioning programme. In the audits, particular attention should be paid to the interfaces and transfers of responsibility that occur between the different groups involved in construction, installation, commissioning and operation.

3. COMMISSIONING PROGRAMME FOR RESEARCH REACTORS

GENERAL OBJECTIVES OF THE COMMISSIONING PROGRAMME FOR A RESEARCH REACTOR

3.1. Requirement 30 of SSR-3 [1] states:

“The design for a research reactor facility shall include features as necessary to facilitate the commissioning process for the reactor facility, including experimental facilities. These design features may include provisions to operate with transient cores of different characteristics.”