

IAEA Safety Standards

for protecting people and the environment

Safety in the Utilization and Modification of Research Reactors

Specific Safety Guide

No. SSG-24



IAEA

International Atomic Energy Agency



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IAEA SAFETY STANDARDS

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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 at the IAEA Internet site

<http://www-ns.iaea.org/standards/>

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 PO Box 100, 1400 Vienna, Austria.

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SAFETY IN THE UTILIZATION
AND MODIFICATION OF
RESEARCH REACTORS



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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-24

SAFETY IN THE UTILIZATION AND MODIFICATION OF RESEARCH REACTORS

SPECIFIC SAFETY GUIDE

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2012

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FOREWORD

by Yukiya Amano
Director General

The IAEA's Statute authorizes the Agency to "establish or adopt... standards of safety for protection of health and minimization of danger to life and property" — standards that the IAEA must use in its own operations, and which States can apply by means of their regulatory provisions for nuclear and radiation safety. The IAEA does this in consultation with the competent organs of the United Nations and with the specialized agencies concerned. A comprehensive set of high quality standards under regular review is a key element of a stable and sustainable global safety regime, as is the IAEA's assistance in their application.

The IAEA commenced its safety standards programme in 1958. The emphasis placed on quality, fitness for purpose and continuous improvement has led to the widespread use of the IAEA standards throughout the world. The Safety Standards Series now includes unified Fundamental Safety Principles, which represent an international consensus on what must constitute a high level of protection and safety. With the strong support of the Commission on Safety Standards, the IAEA is working to promote the global acceptance and use of its standards.

Standards are only effective if they are properly applied in practice. The IAEA's safety services encompass design, siting and engineering safety, operational safety, radiation safety, safe transport of radioactive material and safe management of radioactive waste, as well as governmental organization, regulatory matters and safety culture in organizations. These safety services assist Member States in the application of the standards and enable valuable experience and insights to be shared.

Regulating safety is a national responsibility, and many States have decided to adopt the IAEA's standards for use in their national regulations. For parties to the various international safety conventions, IAEA standards provide a consistent, reliable means of ensuring the effective fulfilment of obligations under the conventions. The standards are also applied by regulatory bodies and operators around the world to enhance safety in nuclear power generation and in nuclear applications in medicine, industry, agriculture and research.

Safety is not an end in itself but a prerequisite for the purpose of the protection of people in all States and of the environment — now and in the future. The risks associated with ionizing radiation must be assessed and controlled without unduly limiting the contribution of nuclear energy to equitable and sustainable development. Governments, regulatory bodies and operators everywhere must ensure that nuclear material and radiation sources are used beneficially, safely and ethically. The IAEA safety standards are designed to facilitate this, and I encourage all Member States to make use of them.

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 is necessary to take the measures recommended (or equivalent alternative measures). The Safety

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

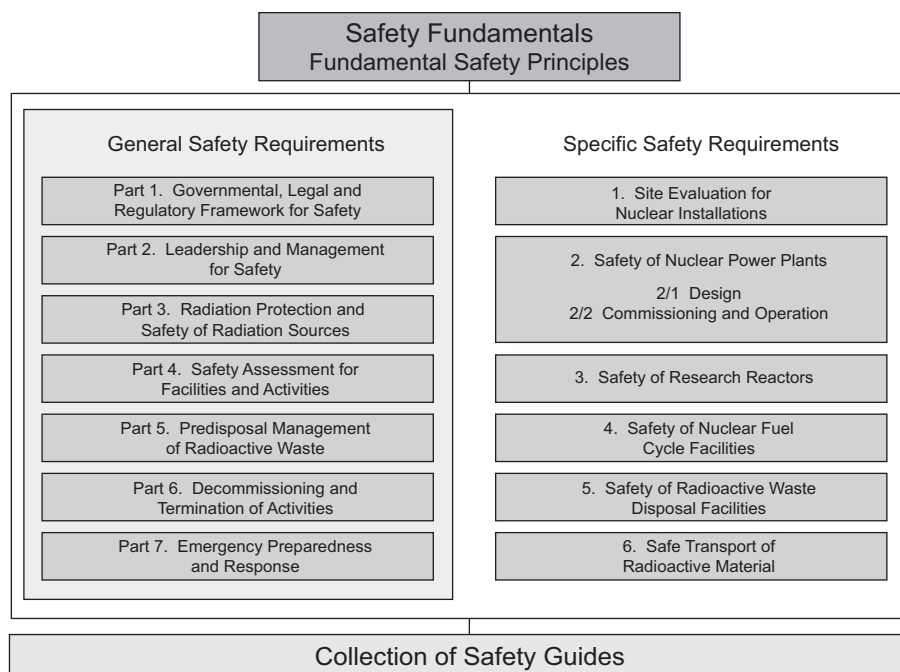


FIG. 1. The long term structure of the IAEA Safety Standards Series.

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 four safety standards committees, for 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. It articulates the mandate of the IAEA, the vision for the future application of the

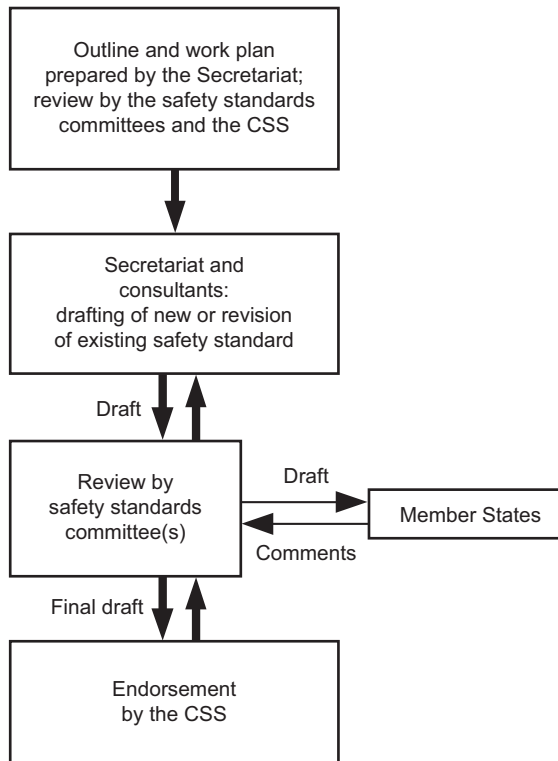


FIG. 2. The process for developing a new safety standard or revising an existing standard.

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 Safety Glossary (see <http://www-ns.iaea.org/standards/safety-glossary.htm>). 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. This Safety Guide was developed under the IAEA programme for safety standards, which covers all of the important areas of research reactor safety. The Fundamental Safety Principles publication [1] establishes principles for ensuring the protection of workers, the public and the environment. This Safety Guide directly addresses four of these principles, i.e. responsibility for safety, optimization of protection, limitation of radiation risks to individuals and prevention of accidents¹. In addition, this Safety Guide provides recommendations on meeting the requirements established in the IAEA Safety Requirements publication on the Safety of Research Reactors [2], for ensuring adequate safety at all stages of the lifetime of a research reactor. In particular, recommendations are provided on which analyses, verifications and evaluations should be performed to fulfil the safety requirements for the operating organization that are established in paras 2.15, 2.18–2.20, 3.6–3.12 and 4.14 of Ref. [2].

1.2. This publication supersedes Safety Series No. 35-G2². The main changes and adaptations relate to consistency with Ref. [2], the other recently published Safety Guides for research reactors and other relevant safety standards. The feedback from the application of Safety Series No. 35-G2 is also incorporated into the present publication.

1.3. Owing to the particular characteristics of research reactors, safety aspects relating to design and operation have been given special emphasis and have been

¹ These are principles 1, 5, 6 and 8 (see Ref. [1]):

- “Principle 1: Responsibility for safety: The prime responsibility for safety must rest with the person or organization responsible for facilities and activities that give rise to radiation risks.”
- “Principle 5: Optimization of protection: Protection must be optimized to provide the highest level of safety that can reasonably be achieved.”
- “Principle 6: Limitation of risks to individuals: Measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm.”
- “Principle 8: Prevention of accidents: All practical efforts must be made to prevent and mitigate nuclear or radiation accidents.”

² INTERNATIONAL ATOMIC ENERGY AGENCY, Safety in the Utilization and Modification of Research Reactors, Safety Series No. 35-G2, IAEA, Vienna (1994).

incorporated into Ref. [2]. These characteristics include the large variety of designs; the wide range of reactor power levels; the different modes of operation and different purposes of utilization; the particularities of siting and the major differences in types of research reactors; and arrangements of operating organizations. These characteristics require a graded approach³ in the application of the requirements (paras 1.11–1.14 of Ref. [2]), i.e. flexibility in the implementation of objectives and the fulfilment of basic requirements when dealing with certain specific topics, such as utilization and modification of research reactors.

1.4. The organizations involved in ensuring the safety of research reactors, and the protection of site personnel, the public and the environment have a number of responsibilities that are interrelated. Most important are the performance of the safety analysis by the operating organization, and the review and assessment of the safety analysis report by the regulatory body, as well as the preparation, submission and evaluation of other important safety related documents during the initial licensing process, periodic licensing renewals or other occasions, such as a periodic safety review or major modification(s) of the research reactor. The recommendations on safety analysis and related documentation, provided in Ref. [4], and on the review and assessment of nuclear facilities by the regulatory body, provided in Ref. [5], have been taken into account in the preparation of the present Safety Guide. In addition, this Safety Guide discusses other aspects of experiments and modifications, such as commissioning of research reactors and provisions for radiation protection, for which detailed recommendations are provided in Refs [6, 7]. The IAEA Safety Glossary [8] defines and explains the safety related words and terms used in the present publication.

OBJECTIVE

1.5. The objective of this Safety Guide is to provide recommendations on meeting the requirements on the safety related aspects of the utilization and modification of research reactors, such that these projects can be implemented without undue radiation risks to the site personnel, the public or the environment. The present Safety Guide develops the general concepts in these areas, which are presented in paras 7.85–7.92 of Ref. [2] relating to utilization and modification. Therefore, this Safety Guide should be read in conjunction with Ref. [2].

³ Further guidance on the graded approach is provided in Ref. [3].

1.6. This Safety Guide provides recommendations to the operating organization, including external users of the research reactor (i.e. experimenters), technical support organizations and other persons involved in utilization and modification projects. It provides recommendations only on the safety implications of the utilization and modification of research reactors. The reason for presenting the areas of utilization and modification together in a single volume is to avoid duplication, since most experiment and modification projects have similar treatments in common areas, such as categorization, safety review and assessment, project implementation and commissioning.

SCOPE

1.7. The recommendations provided in this Safety Guide apply to the utilization of research reactors and to all modifications of research reactors. For some specific, highly complex experimental devices, additional guidance may be necessary. This Safety Guide does not cover experiments in prototype power reactors or experiments performed in operating or decommissioned nuclear power plants.

1.8. In the context of this Safety Guide, utilization is the use of the research reactor or of an experiment or an experimental device during reactor operation. The experiment or experimental device may be situated in the reactor core, the reactor reflector, the shielding or the experimental facilities connected to the reactor, but may also be located outside the biological shielding or outside the reactor building.

1.9. In the context of this Safety Guide, a modification is a deliberate change⁴ in, or an addition to, an existing reactor, a structure, system or component, or item of software important to safety, an experiment or an experimental device. A modification may also involve a change in safety systems, safety related items, operational limits and conditions, procedures, documentation, or operating conditions for the reactor as well as for experiments.

1.10. The requirements for the utilization or modification (i.e. the experiment or modification project) established in Ref. [2] depend on the type of reactor and the

⁴ Experiments and experimental facilities that have been approved in the past or that have been analysed as part of the safety analysis report are not considered to be modifications in the context of the present Safety Guide.

safety significance of the task. However, in all cases, the preparation and implementation of a project for utilization or modification should follow the logical sequence outlined in this Safety Guide. In small projects, the individual stages may be very simple but none of the stages should be omitted.

1.11. Modifications to systems with security aspects should follow the logical sequence outlined in this Safety Guide but will also be subject to confidentiality requirements and security review, which are not discussed.

1.12. In the case of modifications that concern only changes to documentation, the recommendations presented in Section 6 of this Safety Guide are not fully applicable. For such modifications, the additional guidance provided in Ref. [4] should be considered and followed, as applicable.

1.13. Reference [1] states that “Safety measures and security measures have in common the aim of protecting human life and health and the environment.” This Safety Guide addresses nuclear security considerations only briefly in paras 3.35–3.37 and indicates the actions that need to be taken to incorporate security elements progressively into an effective nuclear security regime for a nuclear power programme. Nuclear security matters are covered in IAEA Nuclear Security Series publications. The scope of this Safety Guide includes consideration of the interface between nuclear safety and nuclear security (see Ref. [9] for further information on this issue).

STRUCTURE

1.14. This Safety Guide consists of ten sections and three annexes. In most of these sections, the safety aspects of both the utilization and modification of research reactors are described together. Section 2 provides recommendations on the management system for the utilization and modification of a research reactor. Categorization of the experiment or modification provides a basis for selecting the review and approval route; recommendations on these topics are provided in Section 3. Recommendations on the design of experiments or modifications are provided in Section 4, which should be read in conjunction with the relevant requirements of Ref. [2]. Sections 5, 6 and 7 provide recommendations on the activities that should be considered in the various stages of a typical utilization or modification project. Section 8 covers additional recommendations for operational safety of experiments, and Section 9 provides recommendations on the handling, dismantling, post-irradiation examination and disposal of

experimental devices. Section 10 provides recommendations on the safety of out-of-reactor-core experimental devices and modifications.

2. MANAGEMENT SYSTEM FOR THE UTILIZATION AND MODIFICATION OF A RESEARCH REACTOR

GENERAL

2.1. A documented management system that integrates safety, health, environmental, security, quality and economic objectives of the operating organization of a research reactor is required to be in place [10]. The documentation of the management system should describe the system that controls the planning and implementation of all activities at the research reactor throughout its lifetime, including utilization and modification projects. Approval of the management system (or parts thereof) by the regulatory body may be required. The management system should include four functional categories: management responsibility; process implementation; resource management; and measurement, assessment and improvement. In general:

- Management responsibility includes the support and commitment of management necessary to achieve the objectives of the operating organization.
- Process implementation includes the activities and tasks necessary to achieve the goals of the organization.
- Resource management includes measures necessary to ensure that the resources essential to the implementation of strategy and the achievement of the objectives of the operating organization are identified and made available.
- Measurement and assessment provide an indication of the effectiveness of management processes and work performance compared with objectives or benchmarks. It is through measurement and assessment that opportunities for improvement are identified.

The requirements for the management system are established in paras 4.5–4.13 of Ref. [2], and in Ref. [10], and further recommendations are provided in Refs [11, 12].

2.2. Processes for modifications and utilization should be established as part of the integrated management system. These processes should include the design, review, assessment and approval, fabrication, testing and implementation of a utilization and modification project. Relevant procedures describing the processes should be put into effect by the operating organization early in the utilization or modification project. The management system should cover all structures, systems and components, and processes important to safety, and should include a means of establishing controls over utilization and modification activities, thereby providing confidence that they are performed safely in accordance with established requirements. The management system should also include provisions to ensure that modification or utilization activities are planned, performed and controlled in a manner that ensures effective communication and clear assignment of responsibilities. In establishing the management system, a graded approach based on the relative importance to safety of each item or process may be applied.

2.3. The objective of the management system is to ensure that the research reactor meets the requirements for safety as derived from:

- National laws and regulations;
- The requirements of the regulatory body;
- Design requirements and assumptions;
- The safety analysis report;
- Operational limits and conditions;
- The administrative requirements established by the management of the research reactor.

2.4. The management system should support the development, implementation and enhancement of a strong safety culture in all aspects of modification projects and the utilization programme.

MANAGEMENT RESPONSIBILITY

2.5. It is the responsibility of management to ensure that the procedures for utilization and modification describe how these activities are to be assessed, managed, authorized and performed in order to ensure that the objectives of the experiment or modification are met, and safe operation of the research reactor and its safe utilization are ensured. The documentation of the management system for utilization and modification should include descriptions of the organizational structure, functional responsibilities, levels of authority and interfaces for those

assessing, managing, authorizing, performing, controlling or supervising these activities. It should also cover other management measures, including planning and scheduling of activities, resource allocation and human factors.

2.6. The operating organization has the responsibility for preparing and issuing specifications and procedures for utilization and modification of the research reactor. The reactor manager⁵ should be an active participant in the implementation and evaluation of utilization and modification activities. The detailed responsibilities of the reactor manager are set out in paras 2.23 and 2.24 of this Safety Guide, and the detailed responsibilities of the project manager in paras 2.18–2.22.

IMPLEMENTATION OF A UTILIZATION OR MODIFICATION PROJECT

2.7. Activities relating to the utilization or modification of a research reactor should be performed and recorded in accordance with approved procedures and instructions.

2.8. For successful implementation of a utilization or modification project, consideration should be given to the following aspects:

- Planning and prioritization of work;
- Addressing all relevant regulatory requirements;
- Addressing the requirements derived from the operational limits and conditions;
- Evaluation of the feedback of operational experience from similar utilization or modification projects;
- Addressing the maintenance requirements for the experiment or the modified system or component;
- Ensuring the availability of qualified personnel with suitable skills;
- Establishing appropriate operating procedures, including those for assessing and correcting non-conforming items;
- Performing and documenting the required inspections and tests, including those required for commissioning an experiment or modification;
- Performing and documenting the required training and instruction.

⁵ The reactor manager is the member of the reactor management to whom the direct responsibility and authority for the safe operation of the reactor are assigned by the operating organization and whose primary duties comprise the discharge of this responsibility.

2.9. The management system should include measures to control records essential to the performance and verification of utilization and modification activities, including justification and safety assessment, through a system for their identification, approval, review, filing, retrieval and disposal.

2.10. Documents such as the procedures, specifications and drawings for the utilization and modification project, including the operating procedures, should be controlled. In particular, measures should be established for their preparation, identification, review, updating, validation as required, as well as their approval, issue, distribution, revision and archiving.

RESOURCE MANAGEMENT

2.11. The operating organization should provide adequate resources to execute the modification or utilization by:

- Determining the required staff competences and providing training, where appropriate, to ensure that the personnel of the operating organization are competent to perform their assigned work;
- Supervising external personnel (including suppliers) who perform safety related activities and ensuring that these personnel are adequately trained and qualified.

2.12. Personnel who are not directly working for the research reactor and personnel of contracting organizations who are involved in the modification project or utilization should be appropriately trained and qualified for the work they are to perform. Such external personnel should perform their activities under the same controls, and to the same work standards, as reactor personnel. Reactor supervisors should review the work of these external personnel during preparation for work, at the job site during performance of the work, and during acceptance testing and inspection.

2.13. The management system of the operating organization should be extended to include suppliers. The operating organization should ensure that the suppliers, manufacturers and designers have an effective management system in place. The operating organization should ensure, through audits, that the assigned activities are carried out in compliance with the management system.

2.14. The equipment, tools, materials, hardware and software necessary to conduct the work in a safe manner and to ensure that the requirements are met should be determined, provided, checked and verified, and maintained.

MEASUREMENT, ASSESSMENT AND IMPROVEMENT

2.15. Measures should be established for assessment, review and verification to determine whether and to ensure that utilization or modification activities are accomplished as specified in the design. Such measures should include:

- Review of the design and the design procedures;
- Verification of the implementation of activities by inspection and witnessing;
- Review and verification of records, results and reports relating to the design, the implementation of projects and the operation of the reactor, including those on the status of non-conformances and corrective actions;
- Audits of the relevant processes, procedures and documentation;
- Follow-up of the adequacy and timeliness of corrective actions.

2.16. Effective implementation of the management system for the utilization and modification of a research reactor should be assessed by qualified personnel who are not directly involved in performing these activities.

2.17. The operating organization should evaluate the results of such independent assessments and should determine and take the necessary actions to implement recommendations and suggestions for improvement. Operational safety of experiments should be subjected to periodic review by the reactor safety committee.

RESPONSIBILITIES OF THE PROJECT MANAGER

2.18. The operating organization should assign a person, normally a dedicated project manager, to be responsible for the implementation of the project objectives. These responsibilities should include development of a project definition, determination of measures to ensure adherence to established safety criteria, evaluation of the options and management of detailed design, project implementation, commissioning and decommissioning, if relevant.

2.19. The project manager should be responsible for determining the impact of the project on the existing safety analysis report and on the operational limits and conditions. This involves making proposals for the categorization of the modification or experiment and providing the safety documentation in order to enable the operating organization to submit the project for review and approval, as necessary, by the safety committee(s) or the regulatory body. The advice of external specialists and consultants may be sought in performing these duties.

2.20. The project manager should ensure that any contractor or supplier involved in the preparation or implementation of a modification or utilization project is made aware of and complies with the appropriate requirements and regulations.

2.21. The project manager should be responsible for ensuring that adequate precautions are in place to provide protection against radiological and other hazards that may arise during or as a result of the project.

2.22. Possible interactions between different utilization or modification projects that are being implemented or proposed should be considered and analysed.

RESPONSIBILITIES OF THE REACTOR MANAGER

2.23. The reactor manager has direct responsibility for the safety aspects of reactor operation. In this respect, he or she should ensure that any proposal for utilization or modification of the reactor has been demonstrated to be safe, and additional review, and approval, if required, has been carried out by an appropriate body⁶ before implementation of the project commences.

2.24. The reactor manager should be responsible for ensuring that the scheduling of the implementation of the utilization or modification project does not affect safety.

⁶ The appropriate body could be an expert in the relevant field of specialization, the safety committee(s) or the regulatory body.