

IAEA SAFETY STANDARDS SERIES

Modifications to Nuclear Power Plants

SAFETY GUIDE

No. NS-G-2.3



INTERNATIONAL
ATOMIC ENERGY AGENCY
VIENNA

IAEA SAFETY RELATED PUBLICATIONS

IAEA SAFETY STANDARDS

Under the terms of Article III of its Statute, the IAEA is authorized to establish standards of safety for protection against ionizing radiation and to provide for the application of these standards to peaceful nuclear activities.

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www.iaea.org/ns/coordinet

or on request to the Safety Co-ordination Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.

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MODIFICATIONS TO 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 Mohamed ElBaradei
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 advisory 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 also not explicitly considered; it is recognized that States should fulfill 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 fulfill 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's programme for safety standards for nuclear power plants. It supplements Section 7 of the Safety Requirements publication on Safety of Nuclear Power Plants: Operation [1], which establishes the safety requirements for the modification of nuclear power plants.

1.2. Reasons for carrying out modifications to nuclear power plants may include: (1) maintaining or strengthening existing safety provisions and thus maintaining consistency with or improving on the current design; (2) recovering from plant faults; (3) improving the thermal performance or increasing the power rating of the plant; (4) increasing the maintainability of the plant, reducing the radiation exposure of personnel or reducing the costs of plant maintenance; and (5) extending the design life of the plant. Most modifications, made on the basis of operating experience, are intended to improve on the design or to improve operational performance and flexibility. Some are rendered necessary by new regulatory requirements, ageing of the plant or obsolescence of equipment. However, the benefits of regularly updating the plant design can be jeopardized if modifications are not kept under rigorous control throughout the lifetime of the plant.

1.3. The need to reduce costs and improve efficiency, in combination with changes to the structure of the electricity generation sector of the economy in many countries, has led many companies to make changes in the structure of the operating organization for nuclear power plants. Whatever the reason for such organizational changes, consideration should be given to the effects of those changes with the aim of ensuring that they would have no impacts that would compromise the safety of the plant.

OBJECTIVE

1.4. The objective of this Safety Guide is to provide guidance and recommendations on controlling activities relating to modifications at nuclear power plants in order to reduce risk and to ensure that the configuration of the plant is at all times under control and that the modified configuration conforms to the approved basis for granting a nuclear power plant operating licence. The main purpose of the recommendations concerning changes of management is to give general guidance on performing those changes in such a way that the safety of the plant is not compromised.

SCOPE

1.5. This Safety Guide deals with the intended modification of structures, systems and components, operational limits and conditions, procedures and software, and the management systems and tools for the operation of a nuclear power plant. The recommendations made cover the whole modification process, from conception to completion.

1.6. The justification for undertaking modifications is outside the scope of this Safety Guide.

1.7. The modification and/or refurbishment of nuclear power plants for the purpose of extending the design lifetime could necessitate many major design modifications and special re-evaluation of plant safety (see Ref. [2]), and is therefore outside the scope of this publication.

STRUCTURE

1.8. Section 2 gives guidance on general methods for modifications that could be implemented at nuclear power plants. Section 3 identifies the roles and responsibilities of various organizations involved in the modification process. Sections 4 and 5 give guidance on the different types of modification and their assessment in respect of safety aspects, and Section 4 provides guidelines on subsequent categorization. Section 6 deals with aspects of temporary modifications. Sections 7 and 8 give guidance on implementation of different types of modifications. Sections 9, 10 and 11 give basic recommendations on quality assurance, training and management of documentation; comprehensive guidance on these matters can be found in the appropriate Safety Guides.

2. GENERAL

2.1. Once a plant is completed and approved for operation, its operation needs to comply with all applicable regulations and standards and other relevant safety requirements. Throughout its lifetime, the plant should be regularly inspected, tested and maintained, in accordance with approved procedures, to ensure that it continues to meet the design requirements and remains consistent with the assumptions and results of the safety analysis.

2.2. However, over its lifetime, a plant may undergo various changes on the basis of the feedback of operational experience, the findings of periodic safety reviews, regulatory requirements, advances in knowledge and/or improvements in technology. In some cases modifications may be necessary for economic reasons (e.g. for increased power or for the use of mixed oxide fuel). In other cases modifications may be necessary to ensure recovery from an identified fault condition or a plant failure.

2.3. No modification to a nuclear power plant, whether temporary or permanent, should affect the plant's ability to be operated safely in accordance with the assumptions and intent of the design.

2.4. Management of the modification should be the responsibility of the operating organization. The extent of the regulatory body's involvement in this process should depend on the safety significance of the modification. All safety relevant modifications should be submitted for review and approval by the regulatory body in accordance with national regulations (see paras 3.11–3.16 and 4.3–4.7). Non-safety-relevant modifications should be documented and accessible to the regulatory body. It should be demonstrated by the operating organization that these modifications do not influence safety. The roles and responsibilities of the organizations involved in the modification process are considered in Section 3.

2.5. Proposed modifications should be categorized according to their safety significance and proposals for modifications should be submitted to the regulatory body for prior approval if required.

2.6. Modifications which may affect safety can be divided into:

(a) Modifications directly relating to plant configuration, i.e.:

- Modifications to structures, systems and components or process software;
- Modifications to the operational limits and conditions;
- Modifications to operating procedures; or
- A combination of these; and

(b) Modifications to management systems:

- Changes in organizational structures or resources;
- Modification of operational management programmes; and
- Modifications relating to safety reassessment tools and processes, including improved knowledge of physical phenomena (from the results of research and development).

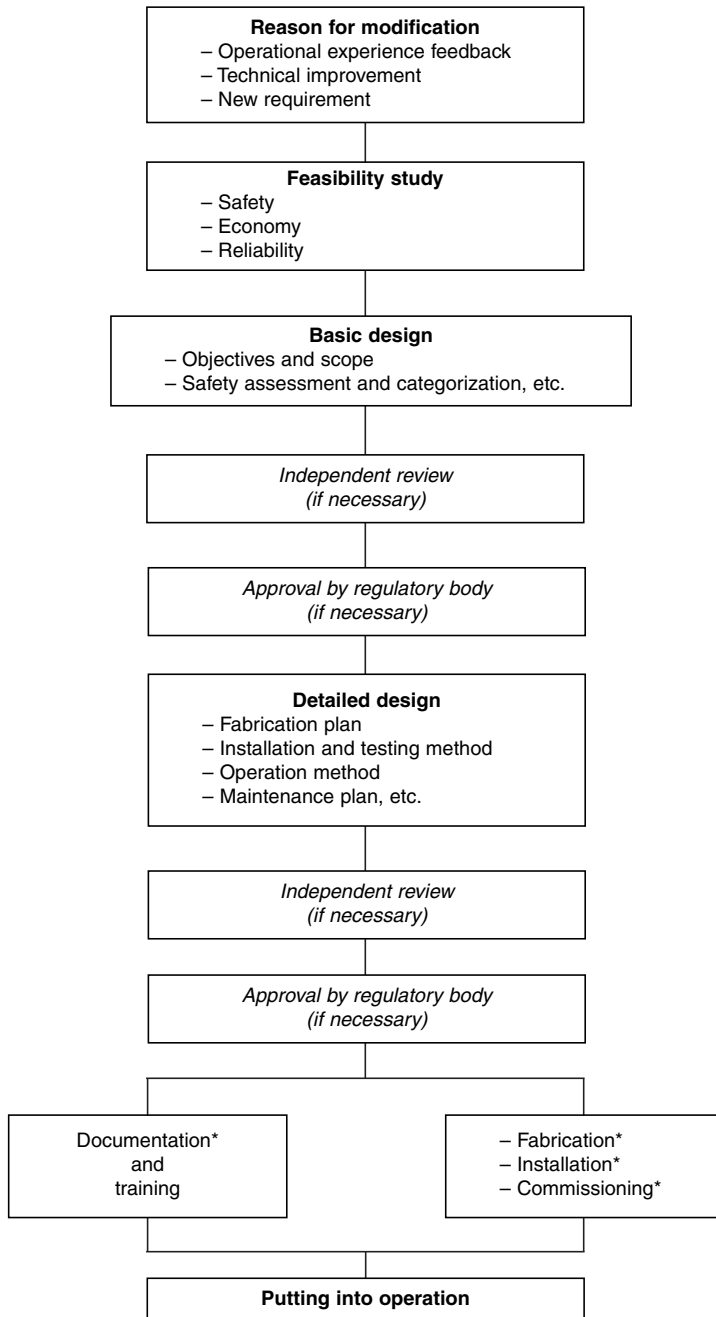


FIG. 1. The basic process for modifications (*: including regulatory inspection (if necessary)).