

IAEA SAFETY STANDARDS SERIES

Decommissioning of Nuclear Fuel Cycle Facilities

SAFETY GUIDE

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FACILITIES

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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 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 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 is issued under the IAEA Radioactive Waste Safety Standards Programme, which addresses all the important areas of radioactive waste safety. This series includes Safety Fundamentals [1], Safety Requirements and Safety Guides in the IAEA Safety Standards Series.

1.2. Safety requirements for decommissioning are set out in the Safety Requirements publication Predisposal Management of Radioactive Waste, Including Decommissioning [2]. Other IAEA safety standards provide additional relevant safety requirements [3]. A Safety Requirements publication, Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety, establishes specific requirements for legal and governmental infrastructures to support decommissioning activities [4].

1.3. Decommissioning is the final stage in the life cycle of a nuclear facility. With the maturing of the nuclear industry, many facilities are approaching decommissioning. Safety management, as demonstrated in the proper planning and implementation of decommissioning, provides for the protection of the health of workers and the public and of the environment.

1.4. This Safety Guide sets out recommendations relating to the decommissioning of nuclear fuel cycle facilities. It includes guidance on selecting the appropriate decommissioning option for the facility concerned, identifies critical tasks and key issues, and discusses methods for managing the decommissioning activities. The guidance is derived from the basic principles for radioactive waste management set out in The Principles of Radioactive Waste Management [1] and the Safety Requirements publication Predisposal Management of Radioactive Waste, Including Decommissioning [2].

1.5. Two other Safety Guides are concerned with the decommissioning of nuclear power plants and research reactors, and the decommissioning of medical, industrial and research facilities [5, 6].

OBJECTIVE

1.6. The objective of this Safety Guide is to provide guidance to regulatory bodies and operating organizations on planning and provision for the safe management of the

decommissioning of non-reactor nuclear fuel cycle facilities. While the basic safety considerations for the decommissioning of nuclear fuel cycle facilities are similar to those for nuclear power plants, there are important differences, notably in the design and operating parameters for the facilities, the types of radioactive material and the support systems available. It is the objective of this Safety Guide to provide guidance for the shutdown and eventual decommissioning of such facilities, their individual characteristics being taken into account.

SCOPE

1.7. This Safety Guide addresses the safe decommissioning of nuclear fuel cycle facilities, such as:

- (a) Surface processing facilities for mining and milling of uranium and thorium,
- (b) Uranium conversion facilities,
- (c) Uranium enrichment facilities,
- (d) Fuel fabrication facilities,
- (e) Spent fuel storage facilities away from the reactor,
- (f) Reprocessing facilities,
- (g) Storage facilities for radioactive waste,
- (h) Treatment and conditioning facilities for radioactive waste.

1.8. Although analytical laboratories, research facilities and laundries are often located on the same sites as nuclear fuel cycle facilities, decommissioning of most facilities of these types is addressed not in the present publication but in another IAEA Safety Guide [6]. However, for complex research facilities where decommissioning would involve decontamination and dismantling activities on a larger or more complex scale, the guidance in the present Safety Guide may be applicable.

1.9. Disposal of associated radioactive waste and closure of waste repositories are not addressed in this Safety Guide but are considered in another publication [7]. The management of mining and milling residues, such as tailings and waste rock, is also outside the scope of this publication. However, the decommissioning of facilities and equipment for surface industrial extraction associated with mining and milling is covered.

1.10. This Safety Guide addresses mainly the radiological hazards resulting from the activities associated with the decommissioning of fuel cycle facilities, primarily with decommissioning after a planned shutdown. Many of the provisions are also applicable to decommissioning after an abnormal event that has resulted in serious system

damage or contamination. In this case, this publication may be used as a basis for developing special decommissioning provisions, although additional considerations will also be necessary.

1.11. Non-radiological hazards, such as those due to potential fire sources or those resulting from the release of asbestos, can also arise during decommissioning activities. This Safety Guide does not explicitly address these hazards, but they should be given due consideration during the planning process and in the risk analysis.

STRUCTURE

1.12. Key issues in the decommissioning of nuclear fuel cycle facilities are addressed in Section 2. The process for selecting the proper decommissioning option is discussed in Section 3. Considerations in facilitating the decommissioning of nuclear fuel cycle facilities are explained in Section 4. Planning and performing a safety assessment for decommissioning of a nuclear fuel cycle facility is the subject of Section 5. Tasks that are critical to decommissioning because of their complexity and/or their relevance to key safety issues are discussed in Section 6. The overall management of the decommissioning process is described in Section 7. Completion of decommissioning and the contents of the final decommissioning report are addressed in Section 8.

1.13. An Annex provides an example of the contents of a final radiological survey report.

2. KEY ISSUES SPECIFIC TO DECOMMISSIONING

GENERAL

2.1. The term ‘decommissioning’ refers to administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a nuclear facility (except for a repository which is ‘closed’ rather than ‘decommissioned’). These actions involve decontamination, dismantling and removal of radioactive materials, waste, components and structures. They are carried out to achieve a progressive and systematic reduction in radiological hazards and are undertaken on the basis of preplanning and assessment, in order to ensure safety during decommissioning operations.

2.2. The time period necessary to achieve decommissioning will depend on the type of installation, the radionuclide inventory, the chosen decommissioning strategy, the techniques employed and, in certain cases, the policy for waste management. The timing of decommissioning shall be such that it does “not impose undue burdens on future generations” in terms of both additional health and safety risks and financial requirements (Ref. [1], principle 5). In the case of fuel cycle facilities which contain long lived alpha contamination, this may mean that early dismantling will be the preferred option.

2.3. Decommissioning may include the phased release of parts of the nuclear fuel cycle facility or parts of the site from regulatory control before the decommissioning process for the entire installation or the entire site is complete. In the event that a part of the installation is being decommissioned, this Safety Guide applies only to the decommissioning activities. However, the potential safety implications with regard to the interaction between any decommissioning work and continuing facility operations should be addressed on a case by case basis.

2.4. Subject to national legal and regulatory requirements [4], a nuclear facility or its remaining parts may also be considered to be decommissioned if they are incorporated into an existing or new facility which is, or will be, under regulatory control. This could apply where the facility to be decommissioned is located on a site with other nuclear facilities, including where the site remains under regulatory or other institutional control. In this case, the dismantling of the remaining facilities should be included in decommissioning planning for the entire site.

2.5. There are many factors that should be addressed to ensure the safety of nuclear fuel cycle facilities during the operational phase. Some of the factors may continue to apply during decommissioning, but decommissioning itself gives rise to issues which are different from those prevailing during the operation of the installation. These issues, which are identified later in this Safety Guide, should be considered in an appropriate way to ensure the overall safety of decommissioning.

RESPONSIBILITIES

2.6. When a nuclear fuel cycle facility is taken out of service, the licence may be reissued, modified or transferred to a different organization which becomes the new operating organization of the installation for the decommissioning phase. Decommissioning activities may involve many additional organizations, including contractors and subcontractors who may not be familiar with nuclear facilities. Responsibilities and interfaces between the different organizations should be properly defined by the

operating organization (licensee). The operating organization (licensee) shall have the ultimate responsibility for safety during the decommissioning operations, even when contractors are used to perform specific tasks or functions (Ref. [2], paras 3.11 and 3.16).

2.7. Responsibilities of organizations involved in the generation and management of radioactive waste, including responsibilities for the safe decommissioning of nuclear fuel cycle facilities, and the specific responsibilities of organizations involved in the decommissioning of nuclear fuel cycle facilities are established in Ref. [4].

2.8. The operating organization shall develop and safely implement the decommissioning plan (Ref. [2], para. 3.13) and shall begin planning for decommissioning in the design and construction stage and continue this during operation (Ref. [2], para. 6.2). The operating organization also:

- (a) Should retain the necessary resources, expertise and knowledge for decommissioning and should keep records and documentation relevant to the design, construction, operation and decommissioning processes so that such information can be transferred to any supporting or successor operating organization;
- (b) Should ensure maintenance of records and documentation for a period of time as specified by the regulatory body following the completion of decommissioning, including key information such as the results of the final radiological survey;
- (c) Should report to the regulatory body on a scheduled basis any safety related information as required by the terms of the licence.

2.9. The operating organization should develop a public information programme to provide information about the decommissioning project.

REGULATORY FRAMEWORK

2.10. As decommissioning activities have become more frequent, there has been a trend in many countries to develop national regulations or specific guidance. The regulatory framework of a country shall include requirements for the decommissioning of nuclear fuel cycle facilities (Ref. [2], para. 3.4). In the absence of specific regulatory requirements, decommissioning activities could be undertaken on a case by case basis under existing regulations for operational facilities. In such cases, more frequent consultation between the operating organization and the regulatory body should be considered.

2.11. The regulatory control of decommissioning can be accomplished by a single overall licence, separate licences or direct supervision by a regulatory body. It should