

# IAEA Safety Standards

for protecting people and the environment

## Safety Assessment for Facilities and Activities

General Safety Requirements

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No. GSR Part 4 (Rev. 1)



**IAEA**

International Atomic Energy Agency

# 1. INTRODUCTION

## BACKGROUND

1.1. The Safety Fundamentals publication, Fundamental Safety Principles [1], establishes principles for ensuring the protection of workers, the public and the environment, now and in the future, from harmful effects of ionizing radiation. These principles apply to all situations involving exposure to, or the potential for exposure to, ionizing radiation (hereafter termed ‘radiation’).

1.2. Safety assessments<sup>1</sup> are to be undertaken as a means of evaluating compliance with safety requirements (and thereby the application of the fundamental safety principles) for all facilities and activities and to determine the measures that need to be taken to ensure safety. The safety assessments are to be carried out and documented by the organization responsible for operating the facility or conducting the activity, are to be independently verified and are to be submitted to the regulatory body as part of the licensing or authorization process.

## OBJECTIVE

1.3. The objective of this Safety Requirements publication is to establish the generally applicable requirements to be fulfilled in safety assessment for facilities and activities, with special attention paid to defence in depth, quantitative analyses and the application of a graded approach to the ranges of facilities and of activities that are addressed. The publication also addresses the independent verification of the safety assessment that needs to be carried out by the originators and users of the safety assessment. This publication is intended to provide a consistent and coherent basis for safety assessment across all facilities and activities, which will facilitate the transfer of good practices between organizations conducting safety assessments and will assist in enhancing the confidence of all interested parties that an adequate level of safety has been achieved for facilities and activities.

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<sup>1</sup> In general, ‘safety assessment’ is the assessment of all aspects of a practice that are relevant to protection and safety. For an authorized facility, this includes siting, design and operation of the facility. Safety assessment is the systematic process that is carried out throughout the lifetime of the facility or activity to ensure that all the relevant safety requirements are met by the proposed (or actual) design. Safety assessment includes, but is not limited to, the formal safety analysis.

safety assessment are then modified as necessary and the level of resources to be applied is adjusted accordingly.

3.7. A graded approach shall also be taken in applying the requirements for updating the safety assessment (see para. 5.10).

## **4. SAFETY ASSESSMENT**

### **OVERALL REQUIREMENTS FOR SAFETY ASSESSMENT**

#### **Requirement 2: Scope of the safety assessment**

**A safety assessment shall be carried out for all applications of technology that give rise to radiation risks; that is, for all types of facilities and activities.**

#### **Requirement 3: Responsibility for the safety assessment**

**The responsibility for carrying out the safety assessment shall rest with the responsible legal person; that is, the person or organization responsible for the facility or activity.**

4.1. In application of the principles established in the Fundamental Safety Principles [1], paras 3.15, 3.16, a safety assessment shall be carried out for all applications of technology that give rise to radiation risks; that is, for all types of facilities and activities as described in Section 1, para. 1.6.

4.2. The responsibility for carrying out the safety assessment shall rest with the responsible legal person; that is, the person or organization responsible for the facility or activity — generally, the person or organization authorized (licensed or registered) to operate the facility or to conduct the activity. The operating organization shall be responsible for the way in which the safety assessment is carried out and for the quality of the results. If the operating organization changes, the responsibility for the safety assessment shall be transferred to the new operating organization. The safety assessment shall be carried out by a team of suitably qualified and experienced people who are knowledgeable about all aspects of safety assessment and analysis that are applicable to the particular facility or activity concerned.



4.7. In the updating of the safety assessment, account also shall be taken of operating experience, including data on anticipated operational occurrences and accident conditions and accident precursors, both for the facility or the activity itself and for similar facilities or activities.

4.8. The frequency at which the safety assessment shall be updated is related to the radiation risks associated with the facility or activity, and the extent to which changes are made to the facility or activity. As a minimum, the safety assessment shall be updated in the periodic safety review carried out at predefined intervals in accordance with regulatory requirements. Continuation of operation of such facilities or conduct of such activities is subject to being able to demonstrate in the reassessment, to the satisfaction of the operating organization and the regulatory body, that the safety measures in place remain adequate.

4.9. It shall be determined in the safety assessment whether adequate measures have been taken to control radiation risks to an acceptable level. It shall be determined whether the structures, systems and components and the barriers incorporated into the design fulfil the safety functions required of them. It shall also be determined whether adequate measures have been taken to prevent anticipated operational occurrences and accident conditions, and whether any radiological consequence can be mitigated if accidents do occur.

4.10. The safety assessment shall address all the radiation risks to individuals and population groups that arise from operation of the facility or conduct of the activity. This includes the local population and also population groups that are geographically remote from the facility or activity giving rise to the radiation risks, including population groups in other States, as appropriate.

4.11. The safety assessment shall address radiation risks in the present and in the long term. This is particularly important for activities such as the management of radioactive waste, the effects of which could span many generations.

4.12. It shall be determined in the safety assessment whether adequate defence in depth has been provided, as appropriate, through a combination of several layers of protection (i.e. physical barriers, systems to protect the barriers, and administrative procedures) that would have to fail or to be bypassed before there could be any consequences for people or the environment.

4.13. The safety assessment shall include a safety analysis, which consists of a set of different quantitative analyses for evaluating and assessing challenges to safety by means of deterministic and also probabilistic methods. The scope and

the possible release of radioactive material to the environment, that are associated with anticipated operational occurrences or with accidents that lead to a loss of control over a nuclear reactor core, nuclear chain reaction, radioactive source or any other source of radiation.

#### **Requirement 7: Assessment of safety functions**

**All safety functions associated with a facility or activity shall be specified and assessed.**

4.20. All safety functions<sup>7</sup> associated with a facility or activity shall be specified and assessed. This includes the safety functions associated with the engineered structures, systems and components, any physical or natural barriers and inherent safety features, as applicable, and any human actions necessary to ensure the safety of the facility or activity. This is a key aspect of assessment, and is vital to the assessment of the application of defence in depth (see paras 4.47–4.51). An assessment is undertaken to determine whether the safety functions can be fulfilled for all normal operational modes (including startup and shutdown where appropriate), all anticipated operational occurrences and the accident conditions to be taken into account.

4.21. In the assessment of the safety functions, it shall be determined whether they will be performed with an adequate level of reliability, consistent with the graded approach (see Section 3). It shall be determined in the assessment whether the structures, systems and components and the barriers that are provided to perform the safety functions have an adequate level of reliability, redundancy, diversity, separation, segregation, independence and equipment qualification, as appropriate, and whether potential vulnerabilities have been identified and eliminated.

#### **Requirement 8: Assessment of site characteristics**

**An assessment of the site characteristics relating to the safety of the facility or activity shall be carried out.**

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<sup>7</sup> Safety functions are functions that are necessary to be performed for the facility or activity to prevent or to mitigate radiological consequences of normal operation, anticipated operational occurrences and accident conditions. These functions can include control of reactivity, removal of heat from radioactive material, confinement of radioactive material and shielding, depending on the nature of the facility or activity.



4.25. It shall be determined in the safety assessment whether adequate measures are in place to control the radiation exposure of workers and members of the public within relevant dose limits (as required by Principle 6 of the Fundamental Safety Principles [1]), and whether protection is optimized so that the magnitude of individual doses, the number of people exposed and the likelihood of exposures being incurred have all been kept as low as reasonably achievable, economic and social factors having been taken into account (see Principle 5 of the Fundamental Safety Principles [1]).

4.26. In the safety assessment of the provisions for radiation protection, normal operation of the facility or activity, anticipated operational occurrences and accident conditions shall be addressed.

#### **Requirement 10: Assessment of engineering aspects**

**It shall be determined in the safety assessment whether a facility or activity uses, to the extent practicable, structures, systems and components of robust and proven design.**

4.27. Relevant operating experience, including results of root cause analysis of operational occurrences, accident conditions and accident precursors where appropriate, shall be taken into account.

4.28. The design principles that have been applied for the facility are identified in the safety assessment, and it shall be determined whether these principles have been met. The design principles applied will depend on the type of facility but they could give rise to requirements to incorporate defence in depth, multiple barriers to the release of radioactive material, and safety margins, and to provide redundancy, diversity and equipment qualification in the design of safety systems.

4.29. Where innovative improvements beyond current practices have been incorporated into the design, it shall be determined in the safety assessment whether compliance with the safety requirements has been demonstrated by an appropriate programme of research, analysis and testing complemented by a subsequent programme of monitoring during operation.

4.30. It shall be determined in the safety assessment whether a suitable safety classification scheme has been formulated and applied to structures, systems and components. It shall be determined whether the safety classification scheme adequately reflects the importance to safety of structures, systems and components, the severity of the consequences of their failure, the requirement

## **5. MANAGEMENT, USE AND MAINTENANCE OF THE SAFETY ASSESSMENT**

### **Requirement 22: Management of the safety assessment**

**The processes by which the safety assessment is produced shall be planned, organized, applied, audited and reviewed.**

### **Requirement 23: Use of the safety assessment**

**The results of the safety assessment shall be used to specify the programme for maintenance, surveillance and inspection; to specify the procedures to be put in place for all operational activities significant to safety, and for responding to anticipated operational occurrences and accidents; to specify the necessary competences for the staff involved in the facility or activity; and to make decisions in an integrated, risk informed approach.**

### **Requirement 24: Maintenance of the safety assessment**

**The safety assessment shall be periodically reviewed and updated.**

5.1. The safety assessment is key to enabling the operating organization to manage facilities and activities safely. It is also a vital input to the safety report required to demonstrate compliance with regulatory requirements.

5.2. The safety assessment in itself cannot achieve safety. Safety can only be achieved if the input assumptions are valid, the derived limits and conditions are implemented and maintained, and the assessment reflects the facility or activity as it actually is at any point in time. Facilities and activities change and evolve over their lifetimes (e.g. through construction, commissioning, operation, and decommissioning and dismantling or closure) and with modifications, improvements and effects of ageing. Knowledge and understanding also advance with time and experience. The safety assessment shall be updated to reflect such changes and to remain valid. Updating the safety assessment is also important in order to provide a baseline for the future evaluation of monitoring data and performance indicators and, for facilities for the storage and disposal of radioactive waste, to provide an appropriate record for reference with regard to future use of the site.