

Overview of Safety Review and Assessment

Venue, Date

Name of the Expert
Regulatory Activities Section
Nuclear Safety and Security Department



IAEA

International Atomic Energy Agency

Learning Objectives

After going through this presentation the participants are expected to be familiar with:

- the relevant IAEA Safety Standards
- the definition, purpose and scope of safety assessment
- the responsibilities of the Operating Organization/Licensee regarding safety assessment
- the responsibilities of the Regulatory Body regarding safety review and assessment

Content

- Purpose and scope of safety assessment
- Responsibilities of the Operating Organization / Licensee regarding safety assessment
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IAEA Fundamental Safety Principles

IAEA Safety Standards

for protecting people and the environment

Fundamental Safety Principles

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Safety Fundamentals
No. SF-1



- Safety assessments must be conducted to demonstrate that the safety measures necessary to control the hazard, and the design and engineered safety features fulfil the safety functions required of them.
- A facility may only be constructed and commissioned or an activity may only be commenced once it has been demonstrated to the satisfaction of the regulatory body that the proposed safety measures are adequate.
- Safety has to be assessed consistent with a graded approach.

Safety Assessment for Facilities and Activities

General Safety Requirements Part 4

Requirement 4: Purpose of the safety assessment

The primary purposes of the safety assessment shall be:

- to determine whether an adequate level of safety has been achieved for a facility or activity, and
- whether the basic safety objectives and safety criteria established by the designer, the operating organization and the regulatory body, in compliance with the requirements for radiation protection and safety have been fulfilled

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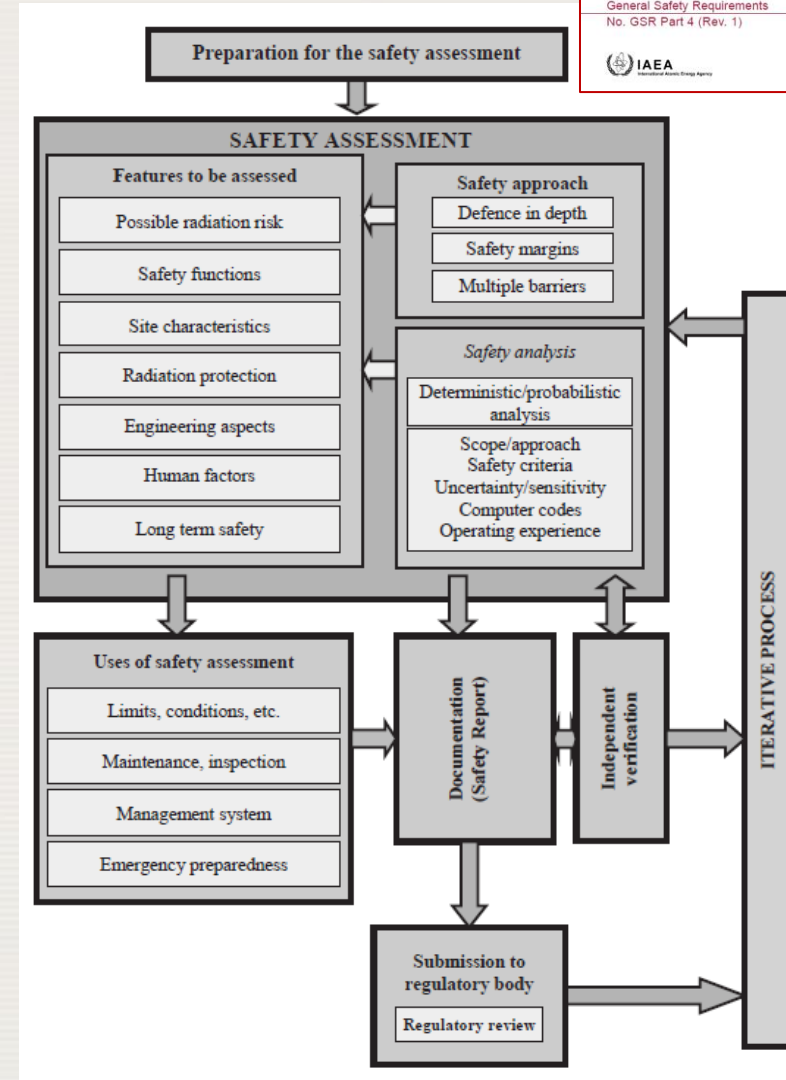
Safety Assessment for
Facilities and Activities

General Safety Requirements
No. GSR Part 4 (Rev. 1)

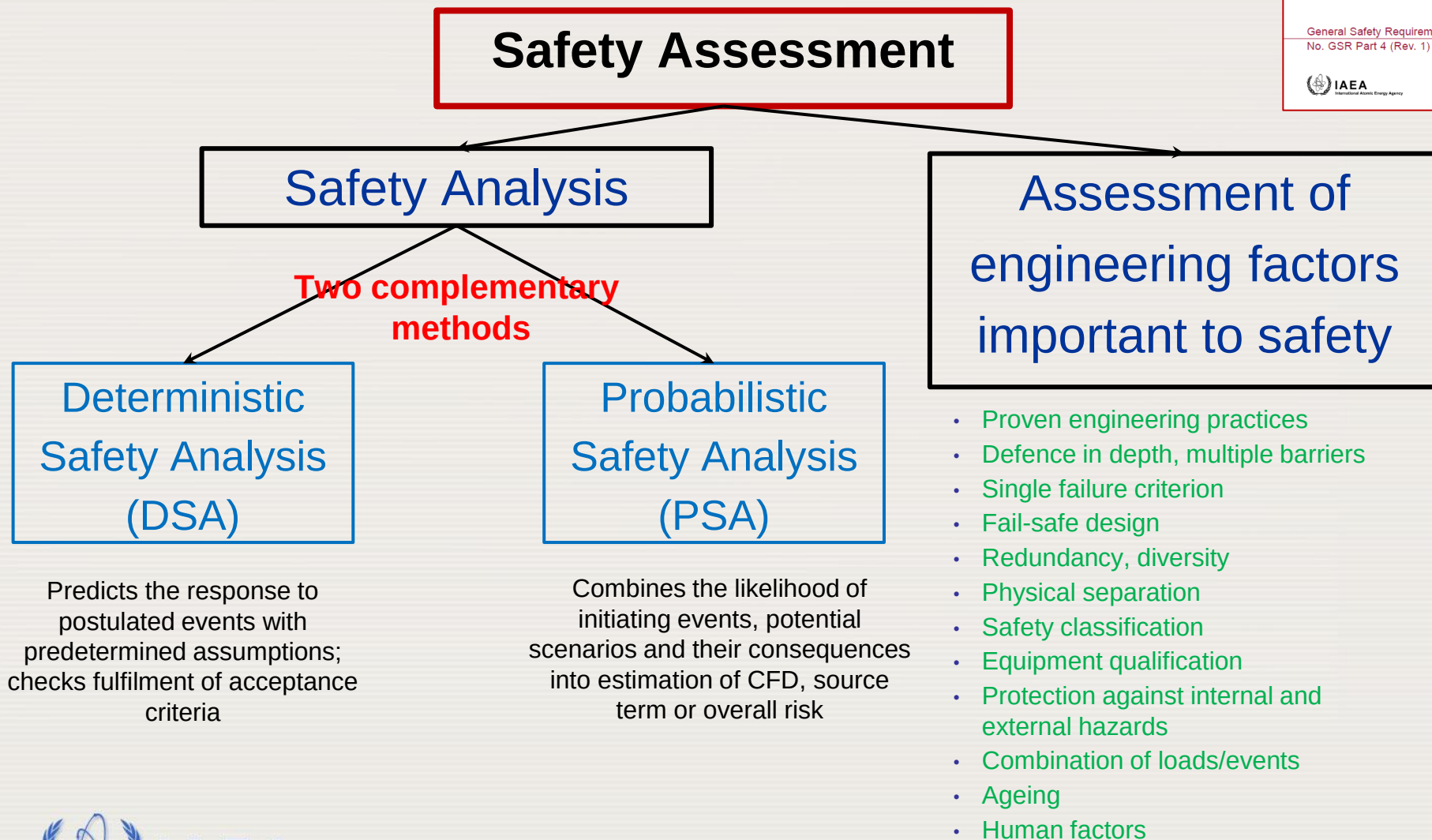


Safety Assessment

- is the assessment of all aspects of a practice that are relevant to protection and safety;
- is 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
- is a 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 and Safety Analysis



THE SAFETY ANALYSIS

‘Safety analysis’ is the evaluation of the potential hazards associated with a facility or an activity. And it shall:

- assess the performance of a facility or activity in all operational states and, as necessary, in the accident conditions to determine whether there is compliance with the relevant safety requirements;
- address both the consequences arising from all normal operational conditions as well as the probabilities and consequences associated with all identified abnormal or accident conditions;
- identify the abnormal and accident conditions that challenge nuclear safety (all internal and external events and processes that may impact on physical barriers to confine the radioactive material);
- determine the cause of the abnormal or accident conditions, its significance and determine the effectiveness of the proposed corrective action.
- shall incorporate **deterministic and probabilistic approaches**, as appropriate.

APPROACHES TO SAFETY ANALYSIS

- **Deterministic approach** defines and applies a set of conservative rules and requirements for the design and operation of a facility or activity. If these rules and requirements are met, they are expected to provide a high degree of confidence that the level of radiation risk to the public and workers will be acceptably low.
- It predicts the response to PIEs with predetermined assumptions; checks fulfilment of acceptance criteria
- The deterministic safety analysis mostly use conservative assumptions. This conservative approach provides a way of compensating for uncertainties in the performance of equipment and the performance of personnel, by providing a large safety margin.

APPROACHES TO SAFETY ANALYSIS

- **Probabilistic approach** determines all significant contributors to the radiological risk from a facility or activity and to evaluate the extent to which the overall design is well balanced and meets probabilistic safety criteria if been defined.
- It uses a comprehensive, structured approach to identify failure scenarios, then combines the likelihood of initiating events, potential scenarios and their consequences into estimation of CFD, source term or overall risk.
- The probabilistic safety analysis use realistic assumptions whenever possible and is able to quantify uncertainties explicitly.
- Probabilistic approaches may provide insights into system performance, reliability, interactions and weaknesses in the design, the application of defence in depth, and risks, that it may not be possible to derive from a deterministic analysis.

Assessment of Engineering Factors

- Proven engineering practices
- Defence in depth, multiple barriers
- Single failure criterion
- Fail-safe design
- Redundancy, diversity
- Physical separation
- Safety classification
- Equipment qualification
- Protection against internal and external hazards
- Combination of loads/events
- Ageing
- Human factors

While the assessment of engineering aspects important to safety may not be explicitly addressed in the safety analysis, it constitutes an important part of the safety assessment.

For some of these aspects, no well-defined acceptance criteria are available and therefore the assessment of the compliance with the safety requirements is *based on* good engineering judgement.

The Role of Safety Assessment

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.

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.

The safety assessment in itself cannot achieve safety.

Content

- Purpose and scope of safety assessment
- Responsibilities of the Operating Organization / Licensee regarding safety assessment
- Responsibilities of the Regulatory Body regarding safety review and assessment

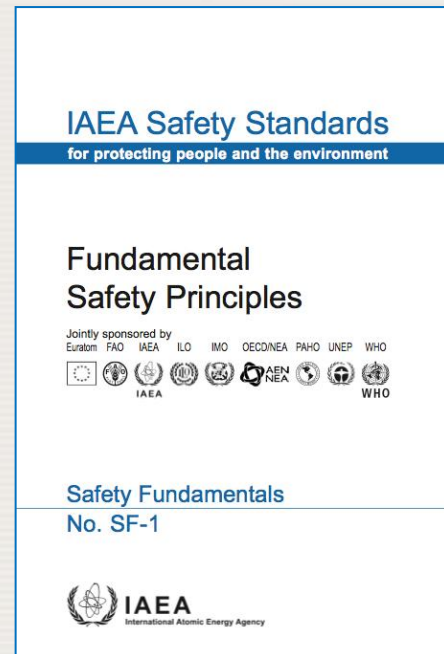
Responsibilities for Safety Assessment

The IAEA Fundamental Safety Principles SF-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.

- The licensee retains the prime responsibility for safety throughout the lifetime of facilities and activities, and this responsibility cannot be delegated.
- Other groups, such as designers, manufacturers and constructors, employers, contractors, and consignors and carriers, also have legal, professional or functional responsibilities with regard to safety.



Responsibilities for Safety Assessment

IAEA Safety Standards
for protecting people and the environment

Safety Assessment for
Facilities and Activities

General Safety Requirements
No. GSR Part 4 (Rev. 1)



Safety Assessment for Facilities and Activities GSR-Part 4

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.

Responsibilities for Safety Assessment

Governmental, Legal and Regulatory Framework for Safety GSR Part 1

Requirement 5: Prime responsibility for safety

The government shall expressly assign the prime responsibility for safety to the person or organization responsible for a facility or an activity, and shall confer on the regulatory body the authority to require such persons or organizations to comply with stipulated regulatory requirements, as well as to demonstrate such compliance.

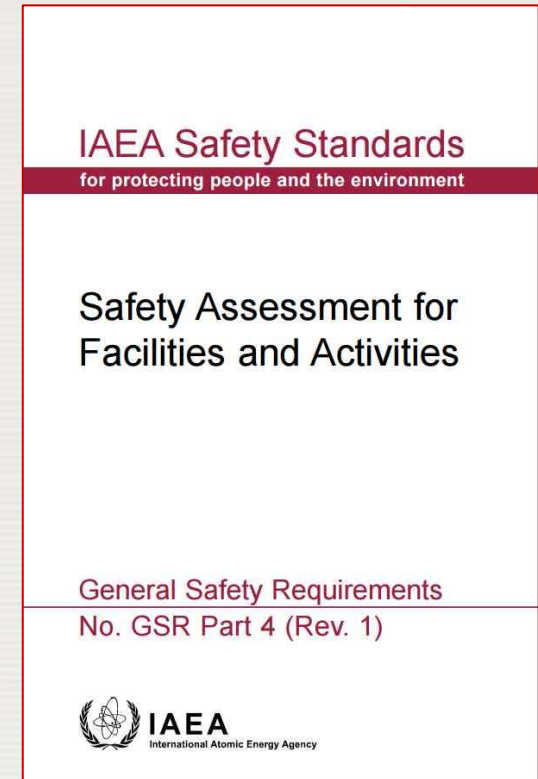
Requirement 24: Demonstration of safety for the authorization of facilities and activities

The applicant shall be required to submit an adequate demonstration of safety in support of an application for the authorization of a facility or an activity.

Verification of the safety assessments

GSR Part 4, Requirement 21: Independent verification

“The operating organization shall carry out an independent verification of the safety assessment before it is used by the operating organization or submitted to the regulatory body.”



Specific Safety Guide SSG-16

PHASE 3

Action 157

Operating organization should, in coordination with the vendor, prepare all the safety documents as required in the licensing process for submission to the regulatory body.

Action 178

The operating organization should conduct an adequate safety review of the designs proposed by the vendors in the submitted bids or contract negotiation, including an assessment of the associated sets of codes and standards.

Specific Safety Guide SSG-16

PHASE 3

Action 179

The operating organization should establish proper interaction with the selected vendor for the preparation of the safety documents.

Action 181

The operating organization should prepare and provide to the regulatory body the safety documents required in the licensing process.

Documents and Information Submitted by the Licensee

More specific and detailed guidance regarding the documents and information should be submitted by the applicant/licensee to regulatory body for review and assessment are provided in the following IAEA Safety Guides

1. Licensing Process for Nuclear Installations **SSG-12**
2. Functions and Processes of the Regulatory Body for Safety **GSG-13**
3. Format and Content of the Safety Analysis Report for Nuclear Power Plants **SSG-61**

<http://www-ns.iaea.org/standards/documents/pubdoc-list.asp?s=11&l=83>

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Responsibility for Review and Assessment

GSR Part 1 – Req. 25: Review and assessment of information relevant to safety

- The regulatory body shall review and assess relevant information —whether submitted by the authorized party or the vendor, compiled by the regulatory body, or obtained from elsewhere — to determine whether facilities and activities comply with regulatory requirements and the conditions specified in the authorization.
- This review and assessment of information shall be performed prior to authorization and again over the lifetime of the facility or the duration of the activity, as specified in regulations promulgated by the regulatory body or in the authorization.

IAEA Safety Standards

for protecting people and the environment

Governmental, Legal
and Regulatory
Framework for Safety

General Safety Requirements Part 1

No. GSR Part 1

Regulatory Review and Assessment

GSR Part 4 Safety Assessment for Facilities and Activities

Section 4.71: “... *the regulatory body shall carry out a separate independent verification to satisfy itself that the safety assessment is acceptable and to determine whether it provides an adequate demonstration of whether the legal and regulatory requirements are being met (It is accepted that the scope and extent of the independent verification carried out by the regulatory body is at the discretion of the State).*”

The verification by the regulatory body is not part of the operating organization’s process and it is not to be used or claimed by the operating organization as part of its independent verification.”

Regulatory Review and Assessment

- It is the responsibility of the regulatory body to determine whether the submissions of the applicant have provided a sufficiently complete, detailed and accurate demonstration of safety of facility and activity.
- The general aim of the regulatory review and assessment of the safety analysis, whether deterministic or probabilistic, is to verify that the safety measures are sufficient to provide adequate assurance for each identified safety criteria.
- Main subjects of the review and assessment are;
 - Organization and management of the applicant
 - Design and performance of structures, systems and components
 - Radiological consequences in normal conditions
 - Analysis of accident conditions

Responsibility for Review and Assessment

GSR Part 1 – Req. 26: Graded approach to review and assessment of a facility or an activity

- Review and assessment of a facility or an activity shall be commensurate with the radiation risks associated with the facility or activity, in accordance with a graded approach.

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Governmental, Legal
and Regulatory
Framework for Safety

General Safety Requirements
No. GSR Part 1 (Rev. 1)



Specific Safety Guide SSG-16

PHASE 2

Action 164.

The Regulatory Body should review and assess the site evaluation report and should make a decision regarding the acceptability of the site selected and the site related design bases.

(This action is to be carried out early in the process of an embarking country considering introduction of nuclear power)

Specific Safety Guide SSG-16

PHASE 3

Action 38.

The Regulatory Body should review and assess programmes to be implemented by the operating organization, as appropriate.

Action 84.

The Regulatory Body should review and assess the operating organization's programme on safety management.

Action 97.

The Regulatory Body should review and assess the operating organization's programme with regard to human resources management.

Specific Safety Guide SSG-16

PHASE 3

Action 120.

The regulatory body should carry out a comprehensive review and an independent verification of the safety analysis reports submitted by the operating organization to verify compliance with the regulatory requirements.

Action 182.

The regulatory body should review and assess the safety documentation, such as the safety analysis reports, and should verify the compliance of the design with regulatory requirements.

Action 183.

The operating organization should ensure the adequate validation and verification of the design of the nuclear power plant and its structures, systems and components, and the regulatory body should review this validation and verification.

Specific Safety Guide SSG-16

PHASE 3

Action 111

The regulatory body should review and assess the radiological environmental impact analysis for the site selected, as appropriate.

Action 115

The regulatory body should review and assess the operating organization's programmes with regard to radiation protection and relevant environmental protection and should verify compliance with the regulatory requirements.

Action 129

The regulatory body should review and assess the operating organization's programmes for waste management and spent fuel management and for decommissioning and should verify their compliance with the regulatory requirements.

Specific Safety Guide SSG-16

PHASE 3

Action 144

The regulatory body should review and assess the emergency plan and emergency procedures for nuclear power plants to the extent necessary to verify compliance with the regulatory requirements.

Action 188

The regulatory body should review and assess the commissioning programme, should verify compliance with requirements and should prepare a programme to oversee the commissioning of systems important to safety in the next phase.

Functions and Process of the Regulatory Body for safety

Review and assessment of facilities and activities

- General
- Objectives of review and assessment
- Information to be reviewed and assessed
- Review and assessment process
- Specific aspects of review and assessment
- Records of review and assessment

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Functions and Processes of the Regulatory Body for Safety

General Safety Guide

No. GSG-13



Organisation, Management and Staffing of the Regulatory Body for Safety

The Safety Guide deals with various aspects such as

- Staffing of the Regulatory Body
- Competence of Staff
- In Table A -9 it describes a process for developing the management system for Review and assessment

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Organization, Management and Staffing of the Regulatory Body for Safety

General Safety Guide

No. GSG-12



Thank you for your
kind attention!

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