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Atoms for Peace and Development

Joint IAEA-ICTP Essential Knowledge Workshop on Nuclear Power Plant Design Safety

ICTP/Trieste, 9 – 20 October 2017

Introduction to IAEA Safety Standards for NPPs Safety Assessment. Purpose and Scope

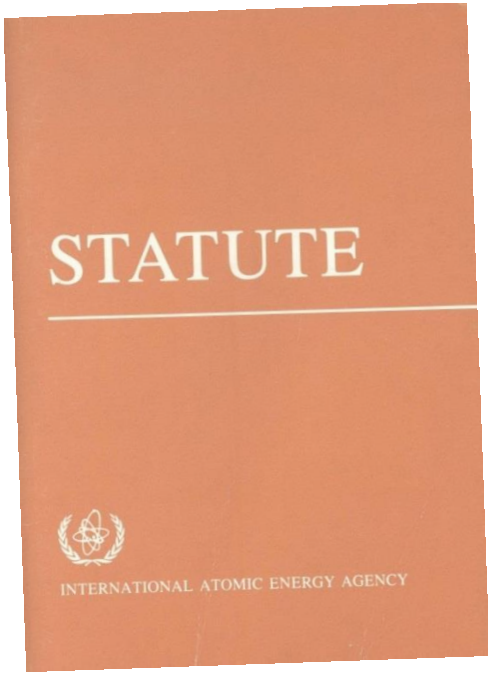
Javier YLLERA
Safety Assessment Section
Division of Nuclear Installation Safety

Outline

- IAEA Safety Standards: Structure. Development and approval process
- Fundamental Safety Principles
- Requirement for NPPs:
- Requirements for Safety Assessment. Purpose and scope of safety assessment

History – IAEA Statute

Under Article III.A.6 of its Statute, the IAEA is authorized:



- *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.*
- *to provide for the application of these standards*

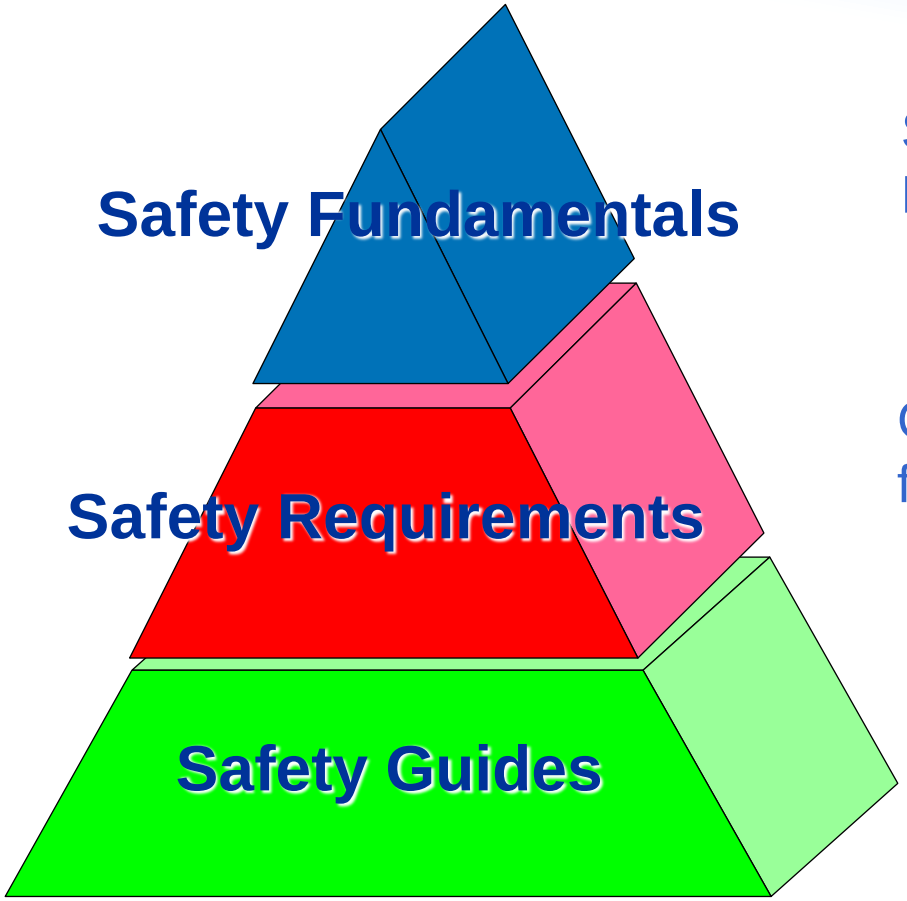
In 1958, the IAEA published its first Safety Standard, Safety Series No. 1, ***Safe Handling of Radioisotopes***. Over the years, nearly 400 publications were issued in the Safety Series.

IAEA Safety Standards

Safety Standards are:

- Non binding on Member States but may be adopted by them
- Binding for IAEA's own activities
- Binding on States in relation to operations assisted by the IAEA or States wishing to enter into project agreements with IAEA

Safety Standards Categories

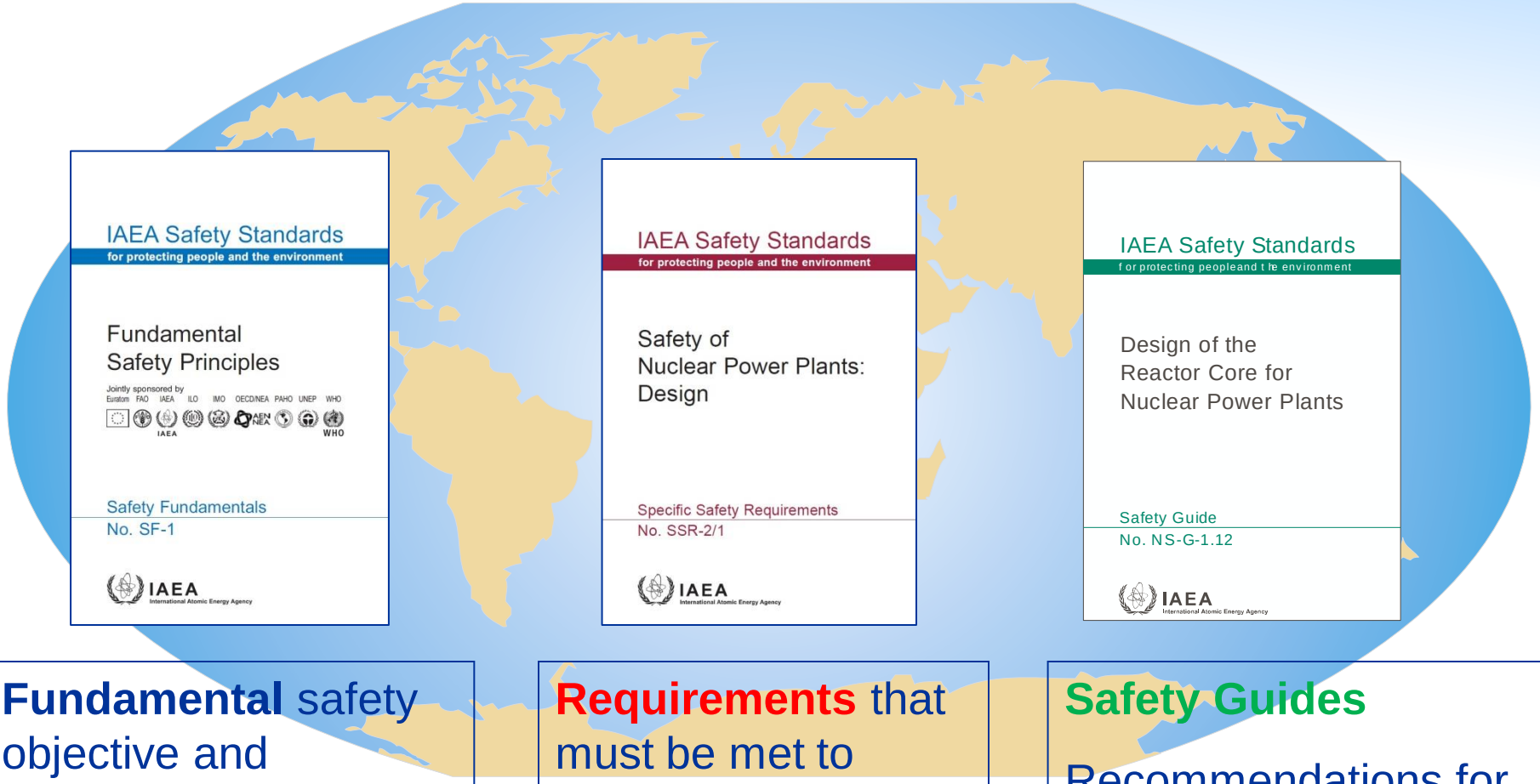


Safety objective and
Fundamental safety principles

Conditions required for
fullfilling safety principles

Guidance on how to meet
the requirements

Safety Standards Categories



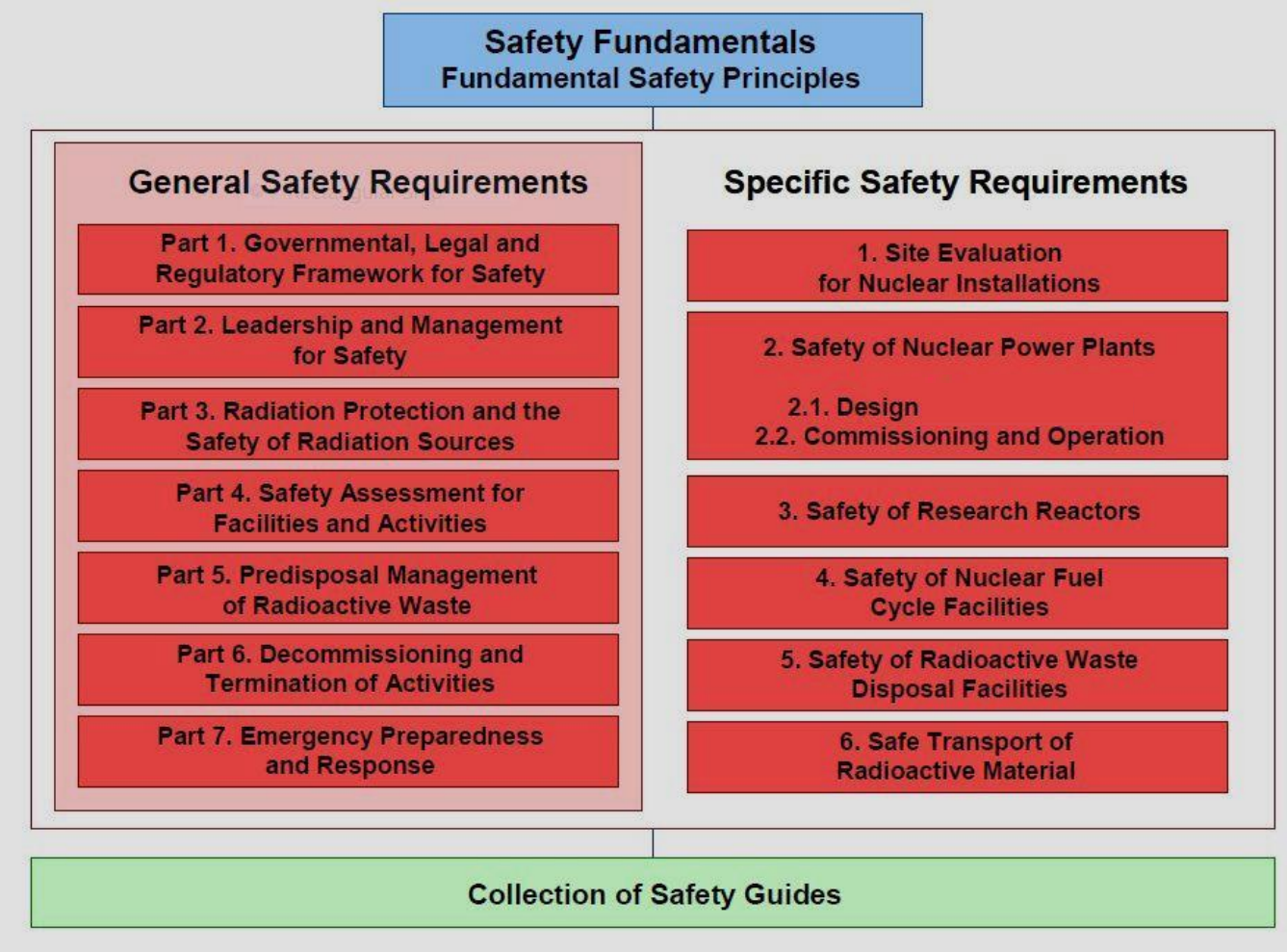
Fundamental safety objective and principles for protecting people and environment

Requirements that must be met to ensure protection of people and environment –'shall'

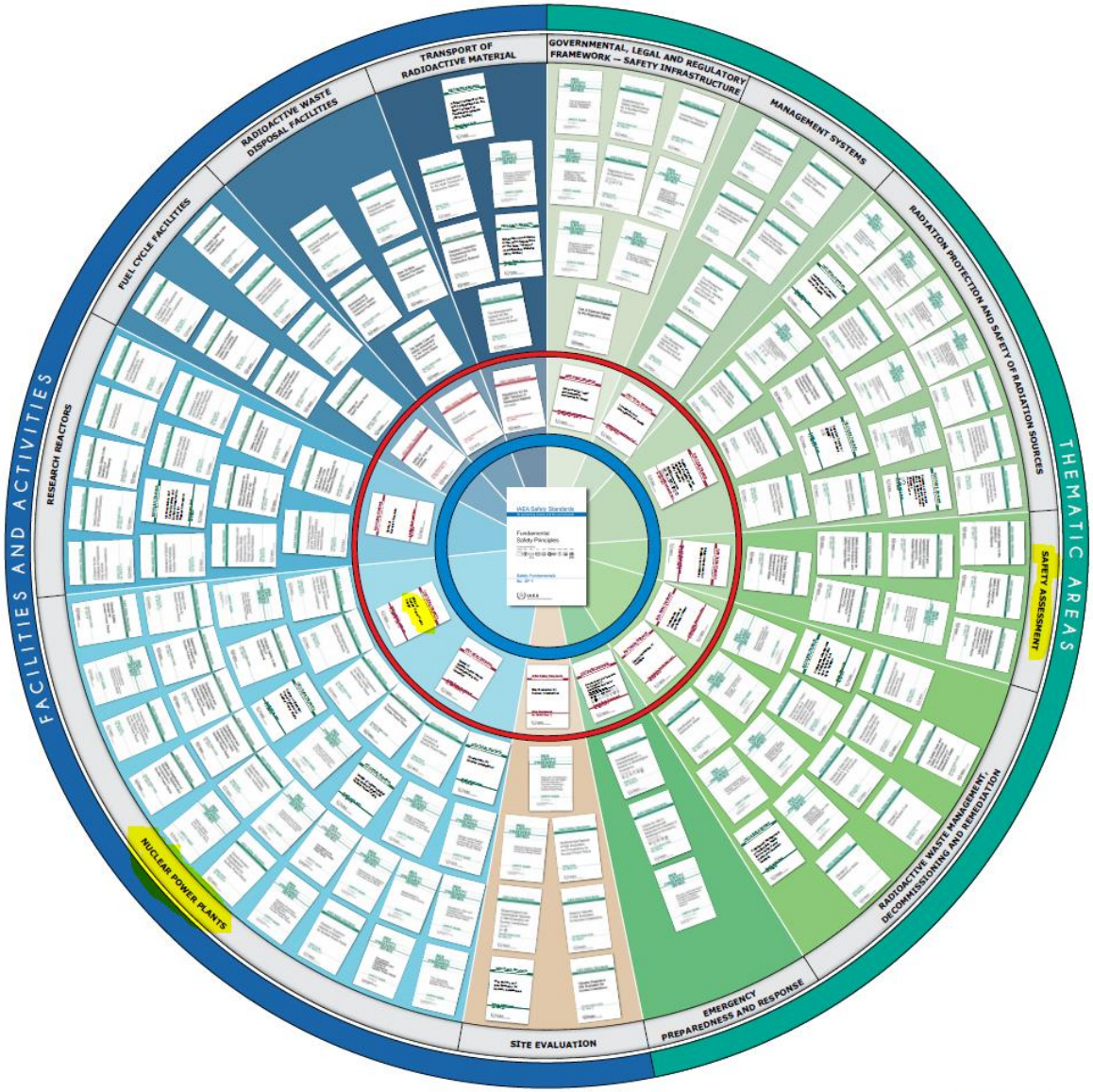
Safety Guides

Recommendations for meeting the requirements – should"

Organization of Requirements and Guides (from 2008)



IAEA Safety Standards Overview

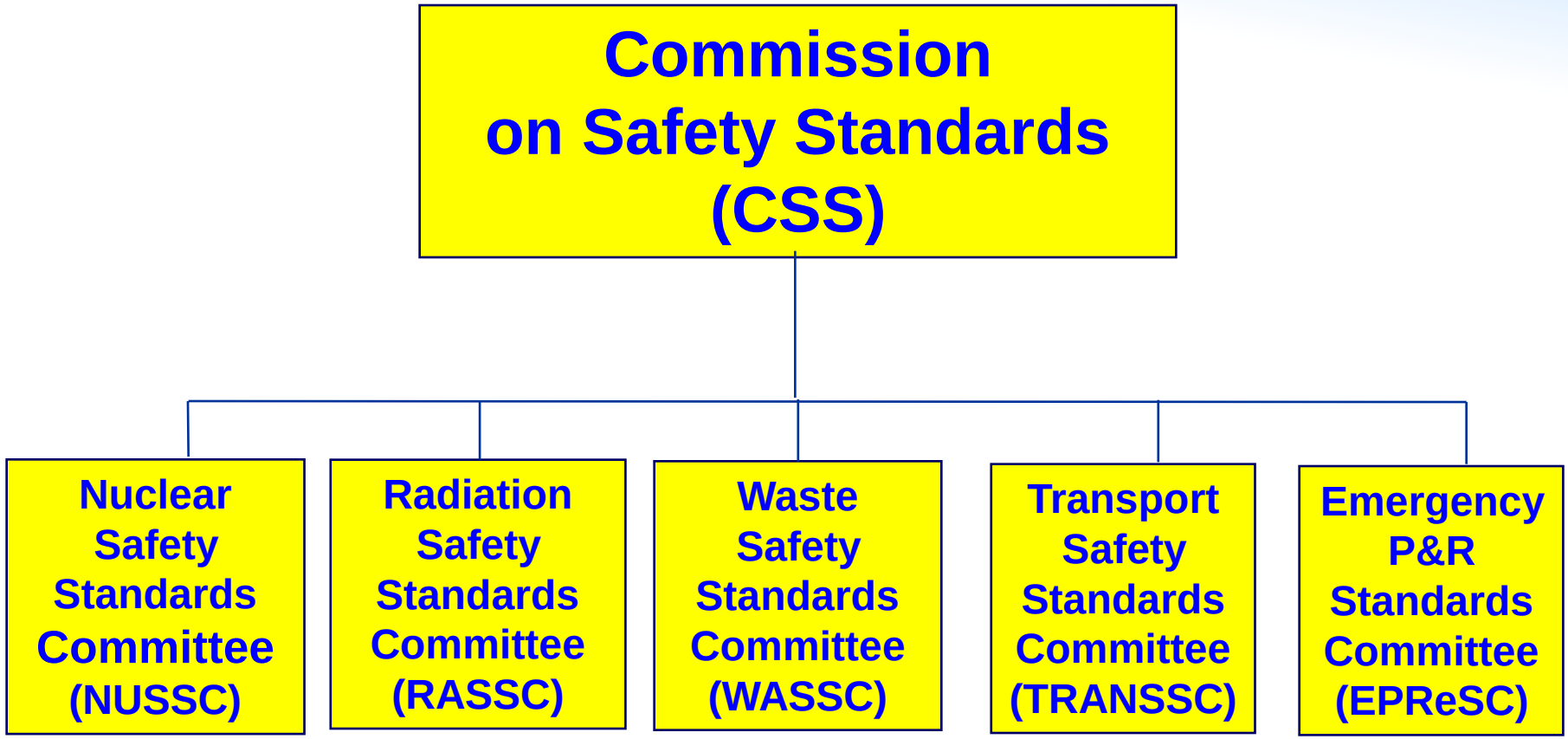


https://www-ns.iaea.org/downloads/standards/safety-standards-wheel-poster.pdf

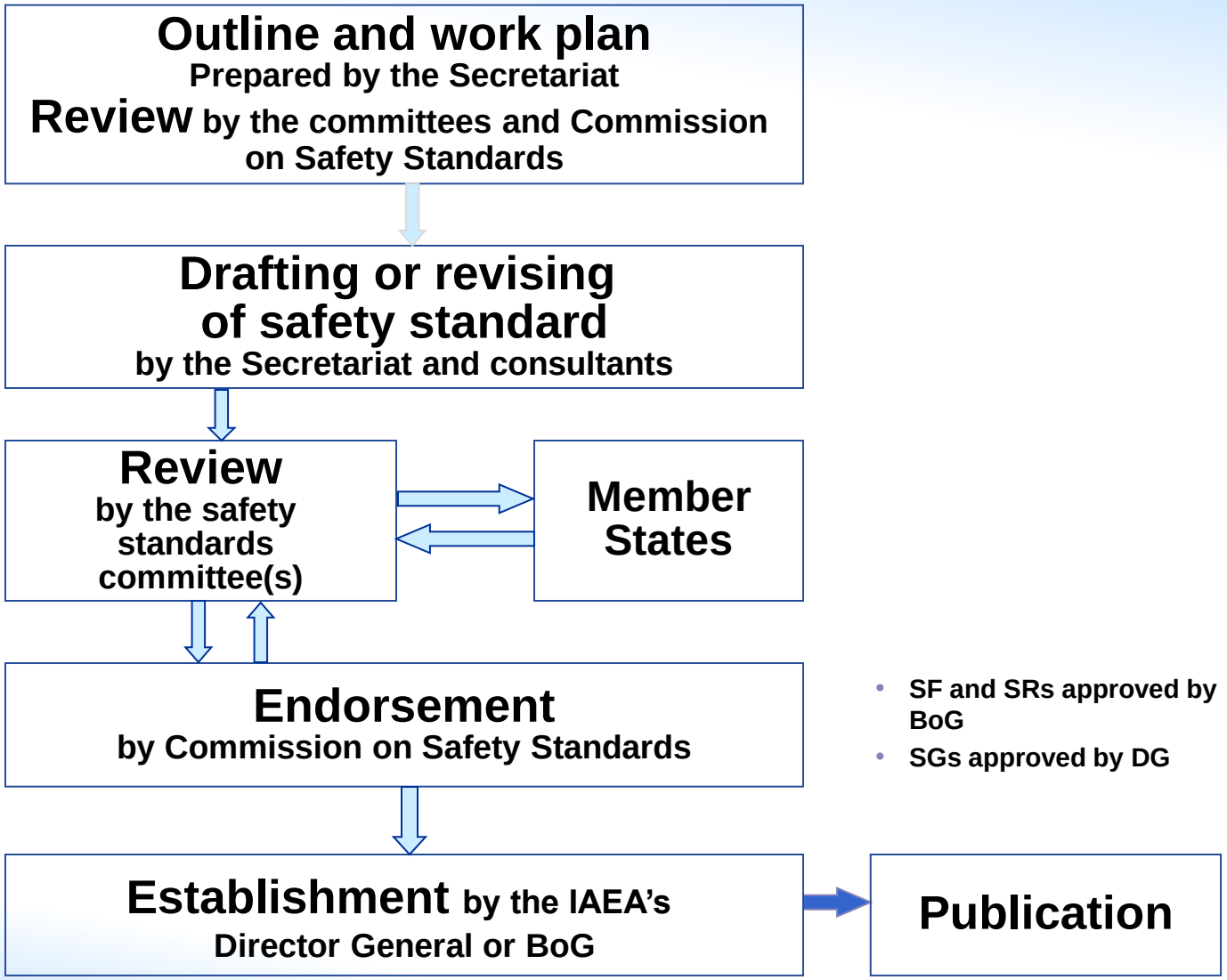
https://www-ns.iaea.org/standards/

https://nucleus-apps.iaea.org/nss-oui

Commission & Committees



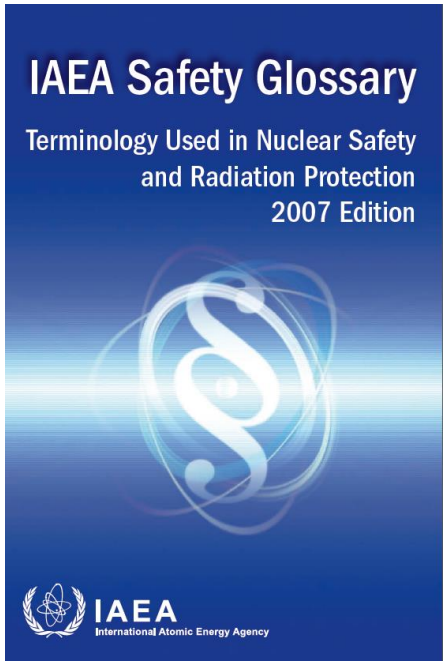
Process Flow for the Development of IAEA Safety Standards



Involvement of Stakeholders

Participation by the different stakeholders (for example, regulators, users and co-sponsors) during the drafting and review phase is a long established practice

IAEA Safety Glossary



- The IAEA Safety Glossary defines and explains technical terms used in IAEA safety standards and other safety related IAEA publications, and provides information on their usage.
-
- The primary purpose of the Safety Glossary is to harmonize terminology and usage in the IAEA safety standards and in the work of the Department of Nuclear Safety and Security generally.
- A revision of 2016 has been prepared but it is not an IAEA publications
- Safety Standards, include definitions that have not been included yet in the glossary or will lead to changes in the definition of the glossary

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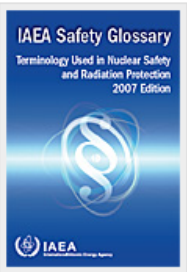
IAEA Safety Glossary 2007 Edition



Introduction

The IAEA Safety Glossary defines and explains technical terms used in IAEA safety standards and other safety related IAEA publications, and provides information on their usage.

Please see Concepts and Terms and please read the Introduction before using the Safety Glossary.

The IAEA Safety Glossary has been in use as Version 1.0 since April 2000. Version 2.0 was issued in September 2006 on this web site and was submitted for publication. The IAEA Safety Glossary: 2007 Edition was published in June 2007 and is available as a sales publication.

The Safety Glossary provides guidance primarily for the drafters and reviewers of safety standards and other publications, including IAEA technical officers and consultants and members of bodies for the endorsement of safety standards.

The primary purpose of the Safety Glossary is to harmonize terminology and usage in the IAEA safety standards and in the work of the Department of Nuclear Safety and Security generally.

Once definitions of terms have been formalized and established, they are, in general, intended to be observed in safety standards and other safety related IAEA publications.

Resources

- IAEA Safety Glossary: 2016 Revision
- Concepts and terms
- Change form

IAEA Safety Glossary - 2007 Edition

- English (2.24mb)
- Arabic (2.16mb)
- Chinese (1.57mb)
- French (1.62mb)
- Russian (6.57mb)
- Spanish (1.59mb)
- CD-ROM

Page - links

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https://www-ns.iaea.org/standards/safety-glossary.asp

IAEA SAFETY STANDARDS – THE VISION

THE IAEA SAFETY STANDARDS: THE GLOBAL REFERENCE FOR PROTECTING PEOPLE AND THE ENVIRONMENT

An integrated, comprehensive and consistent set of up-to-date, user friendly and fit-for-purpose IAEA safety standards of a high quality.

Using and applying the IAEA safety standards will provide for a worldwide harmonized high level of protection for people and the environment from harmful effects of ionizing radiation.

BASIC STRATEGIES

A. Clear categories

B. Clear, logical and integrated structure

C. Clear scope

D. Consensus at the highest level

E. User friendliness

F. Manageable number of safety standards

G. Clarity, rigour and efficiency of the processes

H. Involvement of stakeholders

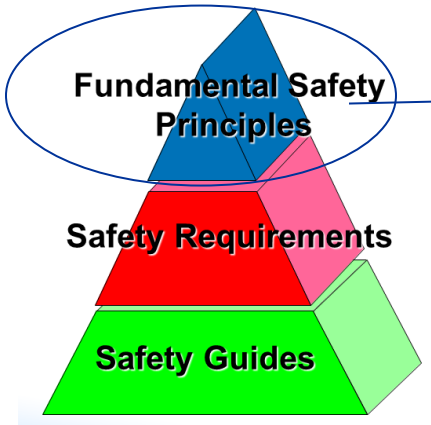
I. Effective feedback mechanisms

J. Harmonized terminology

K. Promotion of the IAEA safety standards

L. Interface between safety and security

IAEA Fundamental Safety Principles (2006)



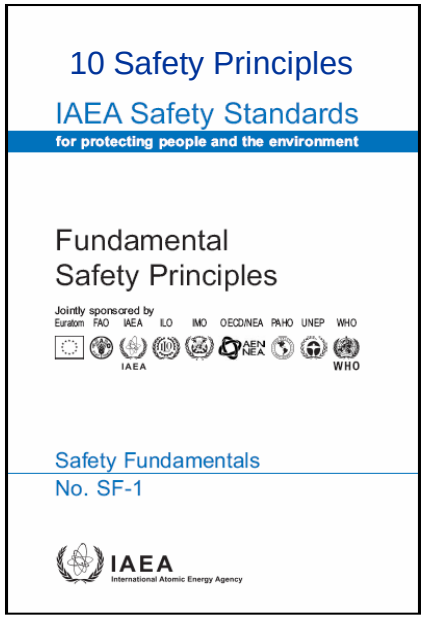
Safety Objective

To protect people and the environment from harmful effects of ionizing radiation

Responsibility for Safety

Role of Government

Leadership and Management for Safety



Protective Actions to Reduce Existing Or Unregulated Radiation Risks

Emergency Preparedness and Response

Prevention of Accidents

Justification of Facilities and Activities

Optimization of Protection

Limitation of Risks to Individuals

Protection of Present and Future Generations

Fundamental Safety Objective

"To protect people and the environment from harmful effects of ionizing radiation"

- Measures have to be taken to:
  - Control the radiation exposure of people and the release of radioactive material to the environment;
  - Restrict the likelihood of events that might lead to loss of control over a nuclear reactor core, nuclear chain reaction, radioactive source or any other source of radiation;
  - Mitigate the consequences of such events if they were to occur.

- The fundamental safety objective applies for all facilities and activities, and for all stages over the lifetime of a facility or radiation source. This includes the associated transport of radioactive material and management of radioactive waste.

Fundamental Safety Principles

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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. (This prime responsibility cannot be delegated).

Principle 2: Role of Government

An effective legal and governmental framework for safety, including an independent regulatory body, must be established and maintained

Principle 3: Leadership and Management for Safety

Effective leadership and management for safety must be established and sustained in organizations concerned with, and facilities and activities that give rise to radiation risks

Fundamental Safety Principles

Principle 4: Justification of Facilities and Activities

Facilities and activities that give rise to radiation risks must yield an overall benefit

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

Fundamental Safety Principles

Principle 7: Protection of Present and Future Generations

People and the environment, present and future, must be protected against radiation risks

Principle 8: Prevention of Accidents

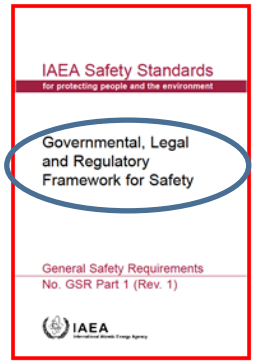
All practical efforts must be made to prevent and mitigate nuclear or radiation accidents

Principle 9: Emergency Preparedness and Response

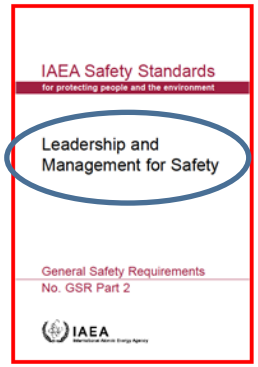
Arrangements must be made for emergency preparedness and response in case of nuclear or radiation incidents

Principle 10: Reduce Existing or Unregulated Radiation Risks

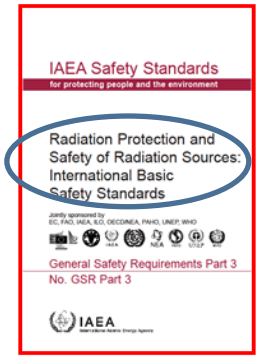
Safety Applicable to NPPs



GSR Part 1 (Rev. 1) Governmental, Legal and Regulatory Framework for Safety

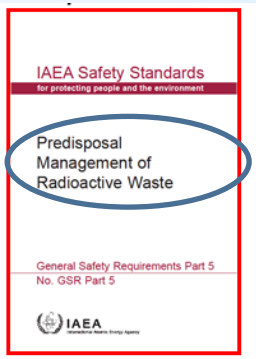


GSR Part 2 Leadership and Management for Safety

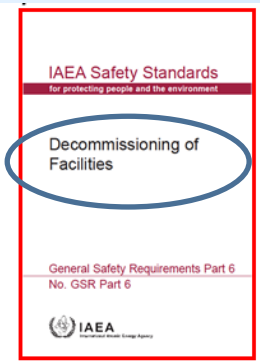


GSR Part 3 Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards

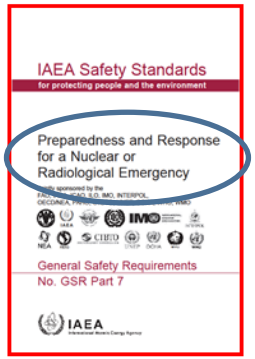
GSR Part 4 (Rev. 1) Safety Assessment for Facilities and Activities



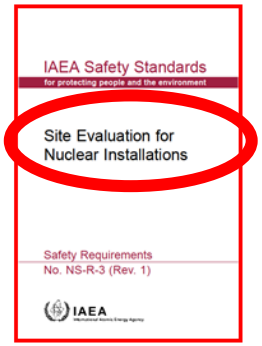
GSR Part 5 Predisposal Management of Radioactive Waste



GSR Part 6 Decommissioning of Facilities



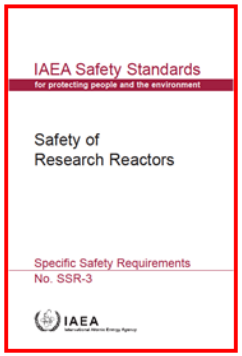
GSR-Part 7 Preparedness and Response for a Nuclear or Radiological Emergency



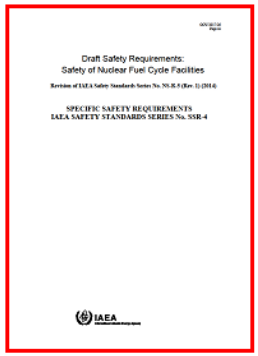
NS-R-3 (Rev. 1) Site Evaluation for Nuclear Installations
UR (DS484)

SSR-2/1 (Rev. 1) Safety of Nuclear Power Plants: Design

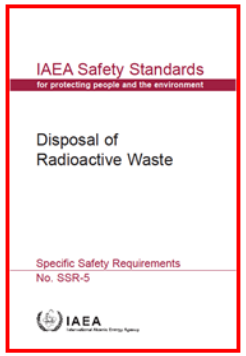
SSR-2/2 (Rev. 1) Safety of Nuclear Power Plants: Commissioning and Operation



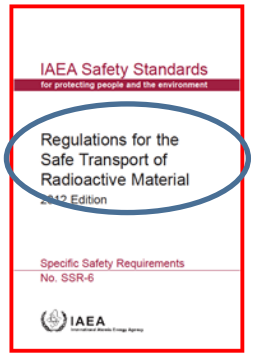
SSR-3 Safety of Research Reactors



SSR-4 Safety of Nuclear Fuel Cycle Facilities



SSR-5 Disposal of Radioactive Waste



SSR-6 Regulations for the Safe Transport of Radioactive Material UR DS495

SAFETY ASSESSMENT

Safety Assessment

- What is safety assessment?
- Who is responsible for safety assessment?
- What is the scope of safety assessment?
- When is safety assessment performed?

Safety Assessment

Safety assessment is the systematic process that is carried out throughout the lifetime of the NPP to ensure that all the relevant safety requirements, including those for siting, design and operation, are met by the proposed (or actual) installation and in this way an adequate level of safety has been achieved (acceptance criteria established for the protection of the workers, the public and the environment are met).

Safety assessment includes, but is not limited to, the formal safety analysis.

Safety Assessment

- What is safety assessment?
- Who is responsible for safety assessment?
- What is the scope of safety assessment?
- When is safety assessment performed?

Responsibility for Safety Assessment

The IAEA Fundamental Safety Principles:

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.

Responsibility for safety assessment (GSR Part 4):

The responsibility for carrying out the safety assessment shall rest with the responsible legal person, i.e. the person or organization responsible for the facility or activity.

The regulatory authority: shall review and assess submissions on safety from the operators both prior to authorization and periodically during operation as required.

Safety Assessment

- What is safety assessment?
- Who is responsible for safety assessment?
- What is the purpose and the scope of safety assessment?
- When is safety assessment performed?

The primary purposes of the safety assessment is to determine whether an adequate level of safety has been achieved, 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 as established in the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, **have been fulfilled.**

The safety assessment has to address all radiation risks that arise from:

- **normal operation,**
- **anticipated operational occurrences, and**
- **accident conditions (in which failures or internal or external events have occurred that challenge the safety).**

- The safety assessment for anticipated operational occurrences and accident conditions also has to address failures that might occur and the consequences of any failures.

Safety Assessment includes

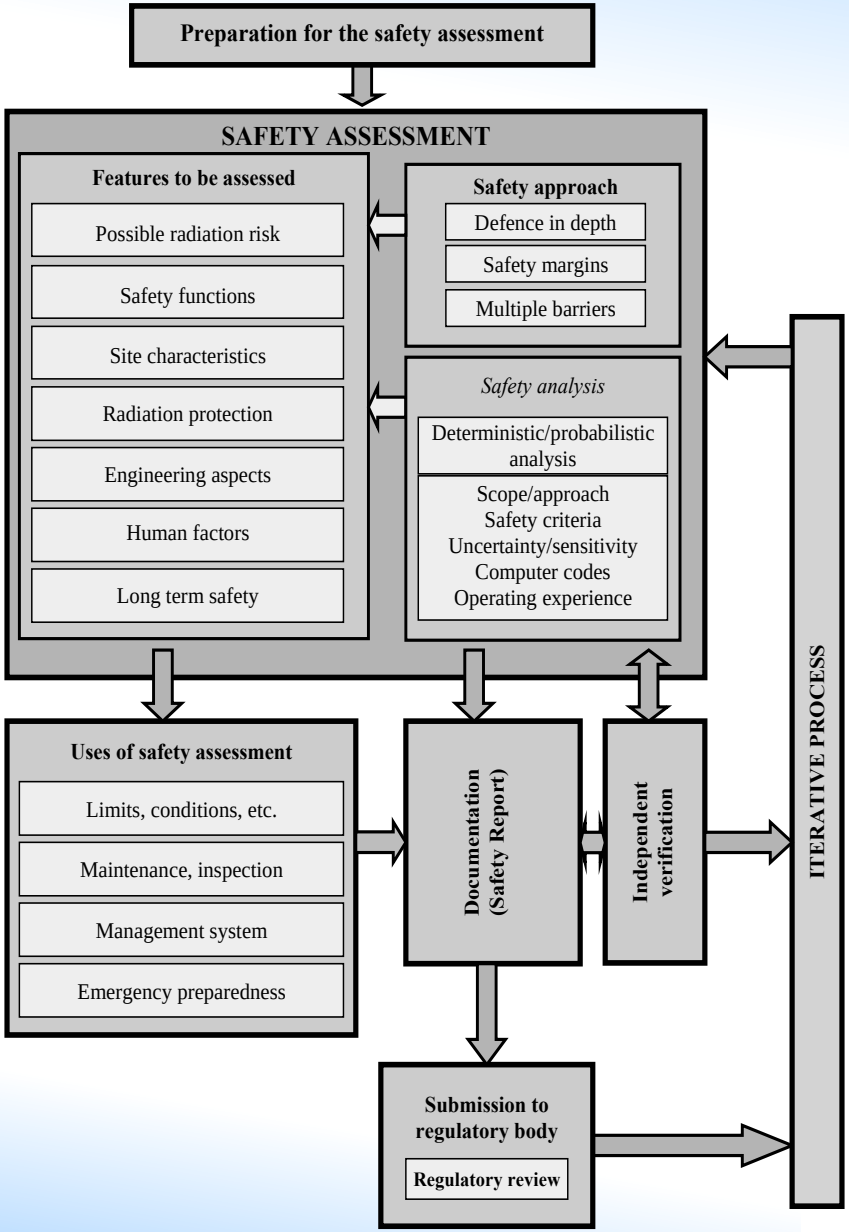
- Evaluation whether

  - **An adequate implementation of defence in depth** has been provided,
  - structures, systems and components of robust and proven design are used;
  - The procedures and safety measures that are provided for all normal operation and accident conditions ensure an adequate level of safety.

Safety Assessment includes

- Assessment of the site characteristics relating to the safety of the facility or activity shall be carried out;
- An assessment of all safety functions associated with the NPP;
- An assessment of the provisions for radiation protection: whether adequate measures are in place to protect people and the environment from harmful effects of ionizing radiation;
- **A Safety analysis**, which consists of a set of different quantitative analyses for evaluating and assessing challenges to safety in various operational states, anticipated operational occurrences and accident conditions, by means of deterministic and also probabilistic methods.

Safety assessment process



Safety Assessment

- What is safety assessment?
- Who is responsible for safety assessment?
- What is the purpose and the scope of safety assessment?
- When is safety assessment performed?

When is safety assessment performed?

Safety assessment has to be carried out at the design stage for a new facility or activity, or as early as possible in the lifetime of an existing facility or activity

The safety assessment needs to be updated as necessary through the stages of the lifetime of the facility or activity to take into account:

- changes in regulations, standards, technological developments, etc.
- changes in site characteristics, and modifications to the design or operation,
- effects of ageing,
- operating experience, including data on anticipated operational occurrences, accident conditions and accident precursors, both for the facility or the activity itself and for similar facilities or activities.

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Thank you!