Training Course
on the IAEA Safety Standards Overview

Overview of the IAEA Safety Fundamentals SF-1

Maria Nikolaki

Safety Standards and Security Guidance Development Section (SSDS), Office of Nuclear Safety and Security Coordination (NSOC)
Department of Nuclear Safety and Security, IAEA

Shinagawa Campus, Tokai University, Tokyo, Japan

17-19, 21 March 2025

Fundamental Safety Objective

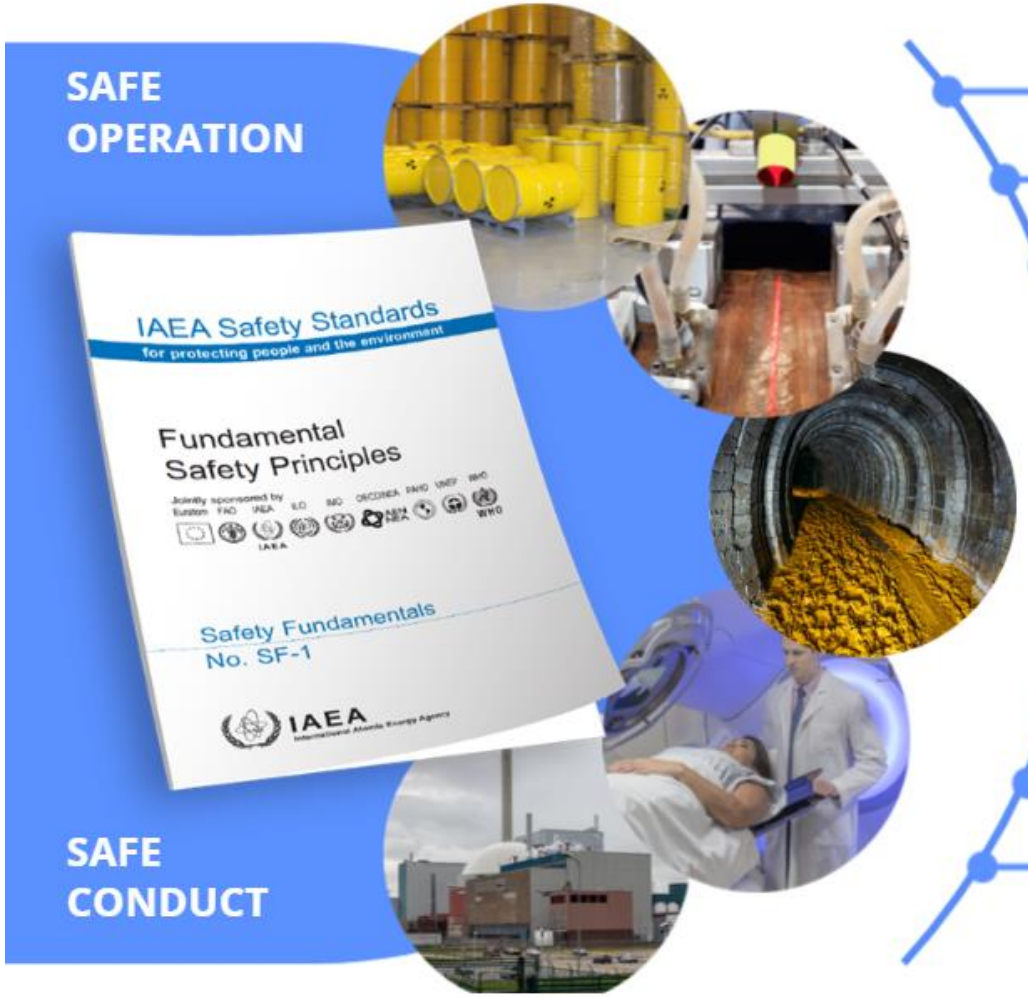
The fundamental safety objective is to protect people and the environment from harmful effects of ionizing radiation.

Protection is to be achieved without unduly limiting the operation of facilities or the conduct of activities that give rise to radiation risks.

The fundamental safety objective applies

- for all facilities and activities
- for all stages of the lifetime of a facility or source:
  - planning
  - siting
  - design
  - manufacturing
  - construction
  - commissioning and operation
  - decommissioning and closure

10 Fundamental Safety Principles



- Responsibility for safety
- Role of government
- Leadership and management for safety
- Justification of facilities and activities
- Optimization of protection
- Limitation of risks to individuals
- Protection of present and future generations
- Prevention of accidents
- Emergency preparedness and response
- Protective actions to reduce existing or unregulated radiation risks

Principle 1: Responsibility for Safety

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

- This responsibility cannot be delegated.
- The individual or organization granted an authorization to operate a facility or conduct a facility is the licensee.
- **The licensee** must:
  - Establish the necessary competencies;
  - Provide adequate training;
  - Establish procedures and arrangements;
  - Verify design and quality;
  - Ensure safe control of radioactive material;
  - Ensure safe control of waste.

Principle 2: Role of government

The prime responsibility for safety must rest with the person or organization responsible for facilities and activities that give rise to radiation risks.

- **The government** must:
  - Adopt legislation, regulations and other standards and measures;
  - Ensure emergency arrangements are in place;
  - Control ‘orphan sources.
- **The regulatory body** must:
  - Have adequate legal authority and human and financial resources;
  - Be effectively independent of the licensee;
  - Inform and consult interested parties about safety.

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.

- Leadership must be demonstrated at the highest levels.
- An effective, integrated management system must be established.
- A safety culture must be in place.
- Safety must be assessed, using a graded approach, and reassessed as necessary.
- Operating experience must be analysed.

Principle 4: Justification of facilities and activities

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

- For facilities or activities to be justified, the benefits that they yield must outweigh the risks.
- Some decisions are taken at the highest levels of government, such as a decision to embark on a nuclear power programme.
- In other cases, the regulatory body may determine whether a proposed facility or activity is justified.
- In the case of medical radiation exposure, the clinical practitioner will decide whether a particular procedure would be beneficial for the patient.

Principle 5: Optimization of protection

Protection must be optimized to provide the highest level of safety that can reasonably be achieved.

- Safety measures are optimized if they provide the highest level of safety that can reasonably be achieved.
- Various factors have to be assessed:
  - The numbers of people who might be exposed
  - The likelihood of the exposures occurring
  - The magnitude and distribution of the doses
  - Radiation risks arising from foreseeable events
  - Economic, social and environmental factors
- The resources devoted to safety have to be commensurate with the magnitude of the radiation risks and their amenability to control.

Principle 6: Limitation of risks to individuals

Measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm.

- Justification and optimization are not enough to guarantee that no individual bears an unacceptable risk.
- Dose limits represent a legal upper limit, so they have to supplemented by the optimization of protection.

Principle 7: Protection of present and future generations

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

- Local and remote populations must be protected, including populations in other countries.
- Ecosystems must be protected at the level of species, rather than individual organisms.
- Future generations must be protected without any need for them to take significant protective measures.
- Radioactive waste must not impose an undue burden on future generations.

Principle 8: Prevention of accidents

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

- Measures must be taken:
  - To prevent the occurrence of failures or abnormal conditions;
  - To prevent the escalation of any such failures or abnormal conditions;
  - To prevent the loss of control over a radioactive source.
- The main means of preventing and mitigating accidents is ‘defence in depth’.
- Implemented through the combination of a number of consecutive and independent levels of protection that would all have to fail before harmful effects could be caused to people or to the environment

Principle 9: Emergency preparedness and response

Arrangements must be made for emergency preparedness and response for nuclear or radiation incidents.

- Arrangements must be in place for an effective response at the scene, at local, regional, national and international levels.
- Licensee, employers, the regulatory body and branches of government all have responsibilities.
- The scope and extent of emergency arrangements depend on:
  - The likelihood and the possible consequences of an emergency;
  - The characteristics of the radiation risks;
  - The nature and location of the facilities and activities.

Principle 10: Protective actions to reduce existing or unregulated radiation risks

Protective actions to reduce existing or unregulated radiation risks must be justified and optimized.

- Radiation risks also arise in situations other than regulated facilities and activities.
  - Radiation of natural origin, e.g. radon gas
  - Past human activities never subject to regulatory control, e.g. residue from mining operations
  - Remediation measures following an uncontrolled release of radionuclides to the environment

Thank you!

Safety-Standards.Contact-Point@iaea.org