

International Atomic Energy Agency

**Nuclear Safety, Regulatory
Framework, Licensibility,
Environmental Impact,
Radiation Protection**

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Nuclear Safety, Regulatory Framework, Licensibility, Environmental Impact, Radiation Protection

- **IAEA Safety Standards and Nuclear Security Series**
- **Regulatory Framework, Regulatory Approach, Licensing Considerations**
- **Impact on the Environment**
- **Radiation Protection**



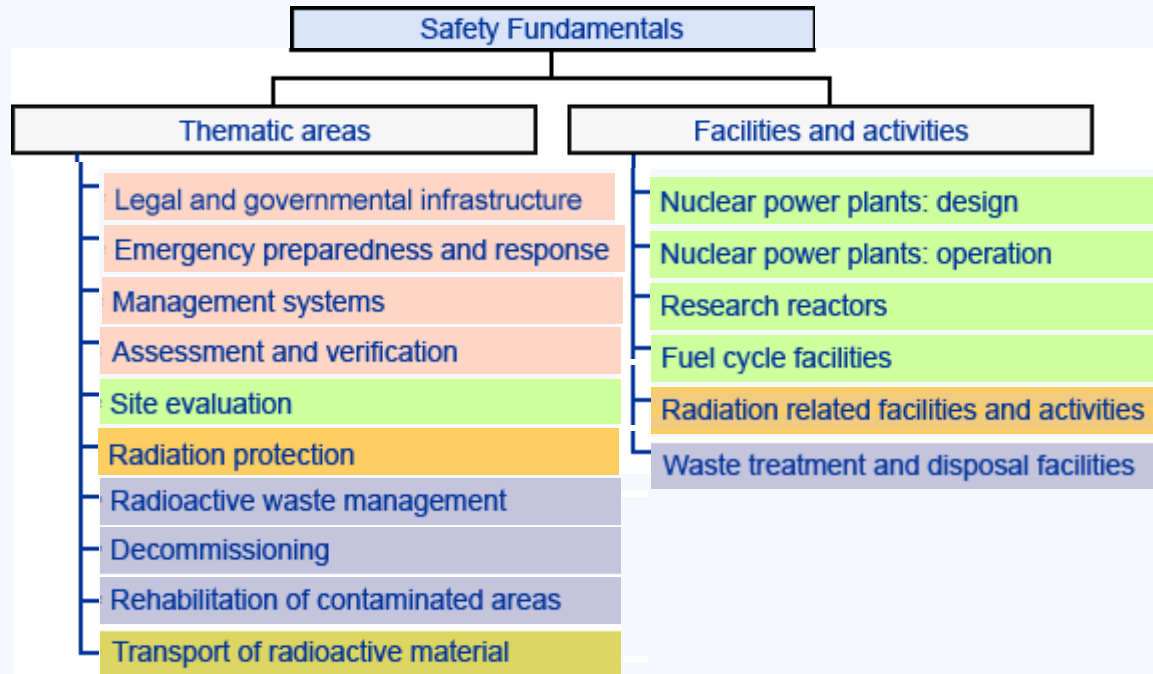
IAEA Safety Standards

IAEA Safety Standards

- **Safety fundamentals**
 - **Establish the fundamental safety objectives, and 10 fundamental safety principles**
- **Requirements**
 - **Cover the functions, measures and actions that have be implemented** **The *WHAT***
- **Safety guides**
 - **Technical guidance and detailed measures to fulfil the requirements** **The *HOW***
- **Safety glossary**



Structure of the Safety Standards



- General safety (cross-cutting themes)
- Safety of nuclear facilities
- Radiation protection and safety of radiation sources
- Safe management of radioactive waste
- Safe transport of radioactive material



Applicability of IAEA Safety Standards for design of NPPs (NS-R-1)

- **NS-R-1 Paragraph 1.3**
- ***"It is expected that this publication will be used primarily for land based stationary reactor power plants with water cooled reactors designed for electricity generation or for other applications (such as district heating of desalination)."***



Applicability of IAEA Safety Standards for design of other (NS-R-1)

- **NS-R-1 Paragraph 1.3**
- ***"It is recognized that in case of other reactor types, including innovative developments in future systems, some of the requirements may not be applicable, or may need judgement in their interpretation."***
- **NS-R-1 is in the process of being revised to make it more technology neutral**



Importance of the requirements for the design

- **Define the safety approach and establish the safety “level” for nuclear power plants**
 - **Reflect the state of the art**
 - **Reflect the views of and the licensing practices of the majority of IAEA Member States**
- **Are used as reference for establishing licensing regulations in several countries**
 - **Adopted as national regulation**
 - **Used as reference for review of national standards and as benchmark for harmonization**



General Safety approach in NS-R-1

- **The general safety approach is mainly based on the concept of defence in depth**
 - **High quality, large conservatism and safety margins**
 - **Plant designed against a broad set of postulated events according to established design criteria**
 - **Capability to deal with conditions that are not considered in the design basis**
- **The deterministic approach is completed by probabilistic evaluations**

IAEA assistance to Member States

- **Safety review services include**
 - **Generic safety review**
 - **Tailored project framework to provide Member States with an early evaluation of a vendor's submission of a new nuclear power plant against the IAEA safety standards at the Fundamentals and requirements level**
 - **Does not constitute any form of licensing activity, nor any kind of design certification. This review does not evaluate the implementation of the requirements, nor does it address the correctness of technical claims made by vendors**

IAEA Generic Safety Review Projects

- **Completeness**

- **Does the documentation provide a complete overview of the safety case or are there gaps; if so are they made explicit and is there any indication of what is being done to fill them ? Is evidence provided that substantiates the safety claims and arguments being made**

- **Comprehensiveness**

- **Are all modes of operation covered ? Are all features of the facility included ? Are lifetime issues covered ?**



IAEA Nuclear Security Series

IAEA Nuclear Security Series

- **Addresses obligations in binding and non-binding international instruments relevant to nuclear security**
- **The process aims to obtain international consensus**
- **3 levels of documents**

IAEA Nuclear Security Series

- **Nuclear security fundamentals**
 - Establish the objectives, concepts and principles of an effective nuclear security
- **Recommendations**
 - Cover the functions, measures and actions that should be implemented The *WHAT*
- **Detailed technical guidance**
 - Implementing guides, technical reports or handbooks : technical guidance and detailed measures The *HOW*
 - Nuclear security glossary



IAEA Nuclear Security Series

- **Published**

- **Nuclear security culture**
- **Engineering safety aspects of the protection of nuclear power plants against sabotage**
- **Preventive and protective measures against insider threats**

IAEA Nuclear Security Series in preparation

➤ Recommendations

- for the protection of nuclear material and nuclear facilities
- for detection and response

➤ Implementing guides and technical guidance

- Development and maintenance of a design basis threat
- Model regulations for security of nuclear material and associated nuclear facilities
- Protection against sabotage
- Identification of vital areas at nuclear facilities
- Computer security at nuclear facilities



Legal and Regulatory Framework

Regulatory Approach

Licensing considerations

Legal & Regulatory Framework

Regulatory Approach

- **Some of the objectives of the technology assessments are**
 - **To assess whether the level of safety provided by the candidate technologies is acceptable and/or to identify potential issues**
 - **About compliance with national regulation**
 - **That would make licensing process difficult**
 - **Engage early discussions to address these issues**
 - ◎ **Regulatory Body**
 - ◎ **Vendor**

Legal & Regulatory Framework

Regulatory Approach

- **Ideally, the safety aspects of the technology assessment should be carried out against the national safety regulation**
- **Many factors can influence the technology assessment**
 - **Nuclear Regulations established ?**
 - **Regulatory approach**
 - **How Prescriptive ?**
 - **Level of development of envisaged technologies**

Legal & Regulatory Framework

Regulatory Approach

- **GS-R-1 “Governmental and Regulatory Framework for Safety”**
 - **Functions of the Regulatory Body**
 - Regulations and guides
 - Review and assessment
 - **Authorization / Licensing**
 - National registers and inventories
 - Inspection
 - Enforcement
 - Information and public communication



Some Licensing Considerations

- **Provide a logical order of decisions needed from different authorities**
- **Public involvement should be held as early as possible**
- **International co-operation with regulatory bodies that have reviewed and possibly licensed the envisaged NPP designs**

Some Licensing Considerations

- **Review key features of the design to identify safety issues that would require modification, development or analysis to achieve regulatory approval of the design**
- **Identify safety relevant design features that would be costly to modify after construction start**
- **Identify human resources, technical and managerial capabilities that will be needed**



Regulatory Framework

Regulatory Approach

Licensing Considerations

- **If the national regulation is not fully established, IAEA Safety Standards can be used as a reference level**
- **Early discussions with vendors, national regulatory body, and foreign regulatory bodies that were previously involved in the review and/or licensing of the designs**
- **Technology assessment is an opportunity to confirm/refine the future needs for human resources and managerial and technical capabilities**



Impact on the Environment

Environmental Impact Assessment

- **Safety Guide soon under preparation**
“Radiation environmental impact analysis for facilities and activities”
 - **Models, methods**
 - **input data**
 - **Use of compliance criteria**
 - **Discussion on optimization**
 - **Discussion on role of monitoring (for input data and for verification)**

Environmental Impact Assessment

- **Data to be provided by potential vendor**

- **Radiological**

- Normal, incidental, accidental release
- location of release, concentration, flow as function of time
- to atmosphere and hydrosphere

- **Non radiological**

- use of water (intake, release)
- chemical release (normal, potential)
- heat, noise, vibration ...
- visual impact on landscape
- ...

Environmental Impact Assessment

- **Level of detail of EIA will depend on**
 - **whether the environmental regulation is defined in detail**
 - **level of detail of data provided by potential vendor**
 - **future site is known**
 - **reference level before construction and site conditions need to be defined with a quality assurance process**
- **Early EIA might help check that no envisaged technology is incompatible with environmental regulation**



Radiation Protection

Radiation Protection

● Fundamental Safety Principles

➤ Justification of Facilities and Activities

- Benefits versus Risks

➤ Optimization of Protection

- Highest level of safety that can be reasonably achieved through the lifetime without unduly limiting its utilization

➤ Limitation of risks to individuals

- Limits fixed by regulation represent upper bounds of acceptability. Cannot be considered separately from optimization



Radiation Protection

- **Consequences on the public of normal and abnormal operation of the plant can be derived from the data used in the EIA**
- **Consequences on the workers**
 - **Estimates of radiation levels in the facility**
 - **Estimates of individual and collective doses for normal and abnormal conditions**
 - **Elements describing how the optimization process was carried out and that the achieved level is satisfactory**

Final considerations

Responsibility for Safety

- **Whatever the regulatory approach adopted and whatever the future role of vendors in the national nuclear power programme**
 - **Responsibility for nuclear safety rests with the State having jurisdiction over a nuclear installation (Convention on Nuclear Safety)**
 - **The prime responsibility for safety must rest with ... the organization responsible for facilities that give rise to radiation risk (Fundamental Safety Principle No. 1)**

