Subject of this presentation: safety assessment

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

Pressurized Water Reactor (PWR)
Fission product release from fuel into coolant

Nuclear reactor installations worldwide

- 439 nuclear reactors in operation in 31 countries, 44 under construction and 120 shut-down
- About 670 Research Reactors have been built to date
- About 248 Research Reactors in 48 countries continue to operate
For operation of facilities or the conduct of activities that give rise to radiation risks the fundamental safety objective is to protect people and the environment from harmful effects of ionizing radiation.

To achieve this measures have to be taken:

- To control the radiation exposure of people and the release of radioactive material to the environment;
- To restrict the likelihood of events that might lead to a loss of control over a nuclear reactor core, nuclear chain reaction, radioactive source or any other source of radiation;
- To mitigate the consequences of such events if they were to occur.

The International Atomic Energy Agency

- Nuclear Energy
- Safety and Security
- Nuclear Science and Applications
- Safeguards
IAEA has statutory obligation to develop international standards of safety

Article III.A.6 of Statute:
- To establish or adopt standards of safety for the protection of health and minimization of danger to life and property
- To provide for the application of these standards

Safety Fundamentals
Safety Guides
Requirements

IAEA SAFETY STANDARDS SERIES
Wide international consensus is achieved through a rigorous development process

Safety Fundamentals
Global reference point for the high level of safety required for use of nuclear energy

Safety Requirements
- Functional conditions required for safety
- Stable - but periodic review and revision if necessary

Safety Guides
- Guidance to fulfill the requirements
- User-friendly and up-to-date practical guidance representing good/best practices

- Science-based and high technical quality
- Expert consensus – Peer and Member-state review
- Transparent and open process

Supporting documentation
Global reference point for the high level of safety required for use of nuclear energy

Ten key principles:

1. Responsibility for Safety
2. Role of Government
3. Leadership and Management for safety
4. Justification of facilities and activities
5. Optimization of protection
6. Limitation of risk to individuals
7. Protection of present and future generations
8. Prevention of accidents
9. Emergency preparedness and response
10. Protective actions to reduce existing of unregulated radiation risk
Safety has to be assessed for all facilities and activities, consistent with a graded approach.

Safety assessment involves the systematic analysis of normal operation and its effects, of the ways in which failures might occur and of the consequences of such failures.

Safety assessments cover the safety measures necessary to control the hazard, and the design and engineered safety features are assessed to demonstrate that they fulfill the safety functions required of them.

Where control measures or operator actions are called on to maintain safety, an initial safety assessment has to be carried out to demonstrate that the arrangements made are robust and that they can be relied on.

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 assessment competence is the key to making the right decisions in design, operation and licensing.

There is no safety without safety assessment.
Subject of this presentation: safety assessment

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

The IAEA Safety Standards on Safety Assessment

http://nucleus.iaea.org/sites/gsan
Safety assessment

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 includes, but is not limited to, the formal safety analysis.
SAFETY ASSESSMENT AND SAFETY ANALYSIS

Safety Assessment

- Safety analysis
- Deterministic safety analysis
- Probabilistic safety analysis

Two complementary methods

Evaluation of engineering factors important to safety
- Proven engineering practices
- Defence in depth
- Radiation protection
- Protection against external hazards
- Selection of materials
- Single failure criterion
- Redundancy, diversity
- Equipment qualification
- Ageing
- Man-machine interface

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

International Atomic Energy Agency

- Why safety assessment is important?
- What is safety assessment?
- Who is responsible for safety assessment?
- What is the scope of safety assessment?
- When is safety assessment performed?
Requirement 3: Responsibility for safety assessment

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 IAEA Fundamental Safety Principles state: 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.

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 for Facilities and Activities
General Safety Requirements Part 4

- **Requirement 1: Graded approach**
  A graded approach shall be used in determining the scope and level of detail of the safety assessment carried out in a particular State for any particular facility or activity, consistent with the magnitude of the potential radiation risks arising from the facility or activity.

- **Requirement 2: Scope of 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.

**Requirements 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 as established in the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, have been fulfilled.
Requirement 5: Preparation for the safety assessment
The first stage of carrying out the safety assessment shall be to ensure that the necessary resources, information, data, analytical tools as well as safety criteria are identified and are available.

Requirement 6: Assessment of the potential radiation risks
The possible radiation risks associated with the facility or activity shall be identified and assessed.

Requirement 7: Assessment of safety functions
All safety functions associated with a facility or activity shall be specified and assessed.

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.

Requirement 9: Assessment of the provisions for radiation protection
It shall be determined in the safety assessment for a facility or activity whether adequate measures are in place to protect people and the environment from harmful effects of ionizing radiation.
**Requirement 10: Assessment of engineering aspects**

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

**Requirement 11: Assessment of human factors**

Human interactions with the facility or activity shall be addressed in the safety assessment and it shall be determined whether the procedures and safety measures that are provided for all normal operational activities, in particular those that are necessary for implementation of the operational limits and conditions, and those that are required in response to anticipated operational occurrences and accidents, ensure an adequate level of safety.

**Requirement 12: Assessment of safety over the lifetime of a facility or activity**

The safety assessment shall cover all the stages in the lifetime of a facility or activity in which there are possible radiation risks.
Requirements 13: Assessment of defence in depth
It shall be determined in the assessment of defence in depth whether adequate provisions have been made at each of the levels of defence in depth.

Requirement 14: Scope of the safety analysis
The performance of a facility or activity in all operational states and, as necessary, in the post-operational phase shall be assessed in the safety analysis.

Requirement 15: Deterministic and probabilistic approaches
Both deterministic and probabilistic approaches shall be included in the safety analysis.

Requirement 16: Criteria for judging safety
Criteria for judging safety shall be defined for the safety analysis.

Requirement 17: Uncertainty and sensitivity analysis
Uncertainty and sensitivity analysis shall be performed and taken into account in the results of the safety analysis and the conclusions drawn from it.

Requirement 18: Use of computer codes
Any calculational methods and computer codes used in the safety analysis shall undergo verification and validation.

Requirement 19: Use of operating experience data
Data on operational safety performance shall be collected and assessed.
Requirement 20: Documentation of the safety assessment
The results and findings of the safety assessment shall be documented.

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.

Requirement 22: Management of the safety assessment
The processes by which the safety assessment is produced shall be planned, organized, applied, audited and reviewed.
The safety assessment shall be periodically reviewed and updated.

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.
Safety assessment competence is the key to making the right decisions in design, operation and licensing.

...Thank you for your attention