Regional Workshop on Application of the Code of Conduct on the Safety of Research Reactors

Lecture 2.2

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The Graded Approach in Application of the Code of Conduct on the Safety of Research Reactors

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The Structure of the Code

- Scope
- Objective
- Application of the Guidance
- Role of the State
- Role of the Regulatory Body
- Role of the Operating Organization
- Role of the IAEA

Application of the Guidance in the Code

States should:

- **Apply the Code through national safety regulations;**
- **Make appropriate use of IAEA Safety Standards;**
- **Apply a graded approach commensurate with the hazard potential;**
- **Communicate any difficulties faced and assistance required in application of the Code to the IAEA.**

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Application of the Guidance in the Code

"Noting that there are many different research reactor designs and power levels resulting in a wide range of hazard potential, the State should adopt a graded approach in application of the guidance in this Code commensurate with the hazard potential, while maintaining a strong safety culture."

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The Graded Approach

General Considerations:

- Research reactors vary greatly in design, siting, operating power, operating mode and utilization, and therefore, in hazard potential.
- All provisions of the Code of Conduct and safety standards should be considered. However, some may not apply, and the degree of rigor in application of others may be graded.

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The Graded Approach

General Considerations:

- Grading should be based primarily on the importance to safety of the provision.
- Grading is primarily done in application of the underlying safety standards that provide detailed technical guidance.
- The basic responsibilities and duties of an organization cannot be graded. Only the manner in which the duties are performed can be graded.

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Hazard Potential

- **Some factors to be considered in assessing the hazard potential:**
  - **Maturity and conservatism of the reactor design;**
  - **Reactor power;**
  - **The potential radiological source;**
  - **Amount and enrichment of fissile and fissionable material;**
  - **Type of fuel elements;**
  - **Type and mass of moderator, reflector and coolant;**
  - **Presence of spent fuel elements near the reactor;**

Hazard Potential

- **Some factors to be considered in assessing the hazard potential:**
  - **Amount and rate of possible reactivity insertion;**
  - **Thermal margins available in cooling;**
  - **Design of safety systems:**
    - **Inherent safety features;**
    - **Reactivity control;**
    - **Decay heat removal and emergency core cooling systems;**
    - **Containment or confinement;**
  - **Site characteristics;**
  - **Proximity to population;**

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Hazard Potential

- **Some factors to be considered in assessing the hazard potential:**
  - **Presence of inherent or passive safety features;**
  - **Overall stability of the reactor system;**
  - **Age and refurbishment of the facility;**
  - **Utilization, including hazards associated with experiments;**
  - **Presence of pressure systems, heating systems or flammables that may impact the reactor.**

Grading of Regulatory Activities

- The State should establish a legal and regulatory infrastructure, including an effectively independent regulatory body.
- The regulatory body should be able to:
  - Conduct authorization;
  - Perform regulatory review and assessment;
  - Conduct inspection and enforcement activities;
  - Establish safety principles, criteria, regulations and guides.
- The regulatory body should have adequate authority and resources.

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Grading of Regulatory Activities

- A graded approach may be applied in the legislative and regulatory infrastructure based on the current and emerging nuclear program.
- The size and structure of the regulatory body should be commensurate with the extent and nature of the facilities and activities it must regulate. It should have enough competent personnel to perform its functions, evaluate the advice of external consultants, and make decisions.

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Grading of Regulatory Activities

- **The authorization process may be graded by combining authorizations for various steps, for example:**
  - **A single authorization for siting, construction, and commissioning;**
  - **A single authorization for initial operation and routine operation after approval of commissioning test results and OLCs.**
- **The breadth and detail of information in the SAR may be graded based on the hazard potential and the stage of the authorization process.**

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Grading of Regulatory Activities

- The scope and frequency of inspection may be proportionate to the hazard potential.
- Inspections should concentrate on areas of safety significance.
- Regulatory response to non-compliances or incidents may also be graded, depending on the nature and complexity of the event.

Grading in the Operating Organization

- **Management of safety:**
  - **A management system having clear policies that give safety the highest priority, that promote a strong nuclear safety culture, and that clearly define responsibilities and lines of communication is essential to safety.**
  - **The complexity and formality of this system may be graded depending on the hazard potential of the facility and the size of the organization.**
  - **The management system should be documented in the quality assurance program and related policies and procedures.**

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Grading in the Operating Organization

- **Assessment and verification of safety:**
  - **Assessment and verification of safety throughout the life cycle of the facility is essential.**
  - **A graded approach may be applied to the scope and depth of analysis in the SAR and to the frequency and scope of periodic safety reviews.**
  - **Such factors as modifications, changes in utilization and significant new experiments, and ageing should be considered in setting the scope and frequency of safety assessment and verification.**
  - **Classification of SSCs, activities and services according to importance to safety may be useful.**

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Grading in the Operating Organization

- Grading may be applied throughout the life cycle of the facility.
  - Siting:
    - The extent and detail of data gathered for site evaluation;
    - The frequency of re-evaluation of siting parameters to ensure continued acceptability.
  - Emergency preparedness:
    - Frequency and nature of emergency drills.

Grading in the Operating Organization

- **Grading may be applied throughout the life cycle of the facility.**
  - **Design:**
    - **Grading of design and QA requirements for the reactor and its SSCs based on function, importance to safety, complexity of design and maturity of the technology;**
    - **Grading of the levels of defense-in-depth and physical barriers to radiological release.**

Grading in the Operating Organization

- Grading may be applied throughout the life cycle of the facility.
  - Operations:
    - Extent and complexity of OLCs, operating and emergency procedures;
    - Degree of rigor in preparation, review, testing and approval of operating procedures;
    - Scope of training and qualification requirements for personnel;
    - Nature and extent of commissioning tests;

Grading in the Operating Organization

- Grading may be applied throughout the life cycle of the facility.
  - Operations:
    - Nature and extent of review of modifications and experiments;
    - Degree of rigor in preparation, review, testing and approval of procedures for maintenance, periodic testing and inspection;
    - Planning, analysis, and performance of core management and fuel handling activities.

Grading in Extended Shutdown

- A preservation plan is recommended for all cases of extended shutdown. The content of this plan may be graded depending on:
  - Purpose of the shutdown;
  - Expected duration of the shutdown;
  - Need for 'mothballing' of the systems;
  - Desire for modification of the SAR and OLCs, and for relief from normal regulatory requirements;
  - Arrangements for storage of fuel and disposition of radioactive materials.

Grading in Decommissioning

- **A preliminary decommissioning plan is recommended for all research reactors. Its contents may be graded depending on:**
  - **The proximity (in time) of decommissioning;**
  - **The plans for financing decommissioning;**
  - **The quantity and types of radioactive materials present or expected;**
  - **The expected complexity of the decontamination and dismantling process and the technologies to be used in the process.**

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Concluding Remarks

- All provisions of the Code of Conduct and safety standards should be considered. However, some may not apply, and the degree of rigor in application of others may be graded.
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Concluding Remarks

- **The basic responsibilities and duties of an organization cannot be graded. Only the manner in which the duties are performed can be graded.**

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