Safety Requirements for Decommissioning of Research Reactors

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Research Reactor Decommissioning Demonstration Project (R2D2P)

26 - 30 June 2006, Manila, Philippines

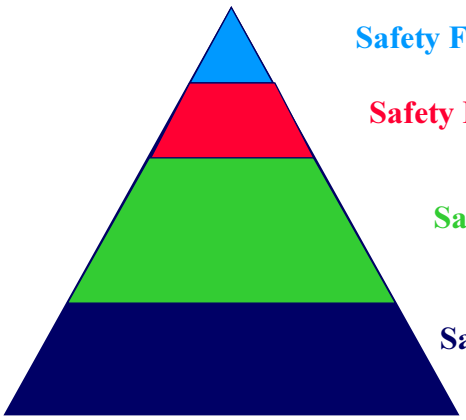
Contents

- Background
- Safety Standards
  - Safety Requirements on Decommissioning
  - Decommissioning regulation
- Standards Supporting Documents
- Current IAEA Focus
- Summary

Background

- **IAEA Statute:**
  - Develop safety standards → Nuclear safety; Radiation Safety; Waste Safety; Transport Safety
  - Provide for their application → Peer reviews; Technical cooperation; Training; Exchange of information; Research and development

Safety Standards Hierarchy



Safety Fundamentals

Safety Requirements

Safety Guides

Safety Reports

Safety Standards on Decommissioning

International Atomic Energy Agency

Safety Standards on Decommissioning (cont.)

- **Safety Requirements on Decommissioning of Facilities (DS333) in print**
- **Safety Requirements on Legal and Governmental Infrastructure, GS-R-1**
- **Decommissioning of Nuclear Power Plants and Research Reactors (WS-R-2.1 of 1999)**
- **Decommissioning of Medical, Industrial and Research Facilities (WS-G-2.2 of 1999)**
- **Decommissioning Fuel Cycle Facilities (WS-G-2.4) 2001**
- **Application of the Concepts of Exclusion, Exemption and Clearance (RS-G.1.7) 2004**
- **Release of Sites from Regulatory Control upon the Termination of Practices (DS-332)**
- **Safety Assessment of Decommissioning of Nuclear Facilities DS376 (in preparation)**

International Atomic Energy Agency

Factors Affecting the Regulatory Process

- Legal systems
- Distribution of authorities among governmental agencies
- Ownership and organisation of nuclear industry
- Availability of qualified personnel and financial resources
- Waste management infrastructure, policies and strategies
- Spent fuel management, policies and strategies
- Funding arrangements (private and state owned facilities) for decommissioning, SF and radioactive waste management
- Prime responsibility for safety - operator

Regulatory Framework

- Legal framework
- Responsibilities
  - State
  - Regulatory Body
  - Other competent authorities
  - Operator
  - Waste management organization
- Regulations
  - Scope of regulation
  - Requirements and criteria
- Mechanisms
  - Authorization
  - Enforcement
  - Appeal
  - Release from regulatory control

Safety Requirements on Decommissioning

Safety Requirements

General

- Activities associated with the decommissioning as part of the original practice and BSS shall be endorsed
  - dose limits for normal exposure of workers and members of the public shall be applied – 20 mSv per year averaged over 5 years
  - clearance, exemption and exlusion principles apply –10 μ Sv/a
  - limitation and optimisation shall applied with due regard to dose constraints – less than 300μ Sv/a
- Environmental protection
  - during the entire decommissioning process and
  - beyond if a facility is released with radiological constraints

Safety Requirements

- Consideration of decommissioning at design stage
- The preferred decommissioning strategy shall be immediate dismantling.
  - Justification for deferred dismantling or entombment options
  - deferred dismantling justification for no undue burdens are imposed
- Consideration of non-radiological aspects of the hazards, such as those due to industrial safety issues or chemical waste
- Provisions for mitigation of potential exposures that may result from an emergency or accident.

Safety Requirements

- States shall include provisions in their national legal framework for:
  - Clear responsibilities of regulators and operators
  - decommissioning, including the preparation of decommissioning strategies and plans
  - establishment of an independent regulatory body for controlling decommissioning activities
  - establishment of funding mechanisms for decommissioning and identification of responsibilities
  - development of a system for the management of the material resulting from decommissioning.
  - Ensure continuity of responsibilities

Safety Requirements

- The Regulatory Body shall establish
  - Control of protection of health, safety and environmental protection
  - All phases of decommissioning, from the initial plan to the final release of the facility from regulatory control
  - Assist in developing policies regarding decommissioning

Safety Requirements

- Develop regulations and guidance
  - criteria for determining when a nuclear facility, or part of a facility is permanently shutdown
  - safety and environmental criteria for the decommissioning, including:
    - conditions on the end points of decommissioning
  - limits and conditions for the removal of controls for facilities containing radionuclides and criteria for the clearance of material during and following decommissioning

Safety Requirements

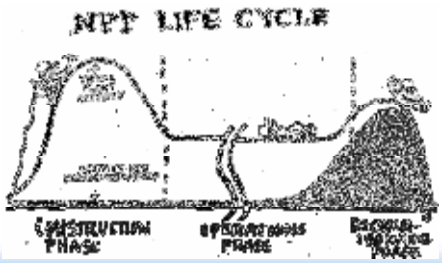
- Issues licences/authorisations
  - require baseline survey of the site, including radiological conditions, prior to construction to obtain information that can be used for comparison purposes with the end state after decommissioning.
  - ensure that adequate arrangements to provide funding for decommissioning are in place before issuing an operating authorization.
- Liaise with other competent authorities

Safety Requirements

- Performs inspection and review of the operator's decommissioning activities and plans
  - ensure that a programme to implement and monitor compliance with regulatory requirements has been established, in case of remaining restrictions after decommissioning
  - evaluate the completion of the end state of the facility after decommissioning activities in compliance with the release criteria
- Ensures long-term records for released sites

Safety Requirements

- Decommissioning shall not start without a satisfactory decommissioning plan
- Regularly reviewed (about 10 y) by operator to reflect changes in:
  - operation
  - regulatory requirements, etc



Safety Requirements

- The operator shall be responsible for all aspects of safety and environmental protection during the decommissioning activities, i.e.:
  - Provide adequate level of safety workers, public and environment
  - Prepare a decommissioning plan
  - Maintain decommissioning plans throughout the life of the nuclear facility
  - Develop the decommissioning plans commensurate with the type and status of the facility and the hazards associated with the decommissioning of the facility

Safety Requirements

- The operator shall:
  - Perform safety assessment shall before start of decommissioning activities:
    - that appropriate measures are taken to prevent such incidents and accidents
    - consequences shall be mitigated if such occur
    - demonstarted that the facilities and operation is adequately safe
    - compliance with relevant requirements and criteria
  - The extent and detail of safety assessment shall be commensurate with the complexity and the hazard associated with the facility or decommissioning operations

Safety Requirements

- Operator shall :
  - Prepare and implement appropriate safety procedures
    - Decommissioning
    - Transfer of the responsibility for the continuity of safety of the facility and for the control of radioactive material
    - Emergency planning arrangements commensurate with the associated hazards are established and maintained
    - Incidents significant to safety are reported to the regulatory body in a timely manner
    - Proper management for all waste streams arising from decommissioning activities
    - Safe storage of the waste is available until final disposal is completed.

Safety Requirements

- Operator shall ensure that:
  - Facilitate decommissioning during design, construction and operation
  - Apply good engineering practice
  - Ensure that staff are properly trained, qualified and competent
  - Establish and maintain records to support decommissioning
  - Adequate financial resources are in place to cover the costs associated with safe decommissioning, including that the management of the resulting waste, are available when needed
  - Financial assurance for decommissioning is obtained prior to the initial operation of the facility

Safety Requirements

- Before site release the operator shall:
  - Survey the site to demonstrate compliance
  - Document the demonstration that the facility meets the end state conditions in a final decommissioning report that is submitted to the regulatory body for review.
- Management programme shall be conducted to provide necessary confidence
  - Decommissioning tasks shall be controlled through the use of written procedures
  - The operator shall ensure appropriate records generated during decommissioning that are relevant to decommissioning:
    - History of facility use
    - Events and incidents
    - Waste retrievals, conditioning, packaging or disposal, etc.

Safety Requirements

- Management system for decommissioning shall also ensure:
  - A management organization and the personnel resources are in place to ensure that the decommissioning can be completed safely
  - Individuals responsible for decommissioning activities are trained to appropriate levels of health, safety and environmental awareness and have the necessary skills, expertise and training to complete the decommissioning safely
  - Provisions are made to maintain the key staff and institutional knowledge about the facility
- Safety culture shall be fostered and maintained

Decommissioning Regulation

- Approaches
  - Phase approach (Bulgaria, Ukraine, etc.)
  - Overall decommissioning process (e.g. UK, France)
- Graded regulatory approach
  - Focus on key and most important safety related issues
  - Verification of compliance with endpoints
- Development and periodic review and update of the decommissioning plan
  - Use of independen review

Regulatory Approval Process

- The operator needs to make an application for an operating license amendment or issuance of a new license for decommissioning
- Certain conditions may be contained in the new or modified license directing how facility is now to be operated
- Some decommissioning documents may require approval by the regulatory body before the activities can be implemented (i.e., decommissioning plan)
- The organization responsible for decommissioning (operator or other organisation) typically submits these documents to the regulatory body

Regulatory Approval Process (cont'd.)

- Upon review the regulatory body may request further information to clarify points
- Upon resolution of points commented upon, the regulatory body will formally transmit its approval to the operator
- Once the regulatory body approves the various documents, there may or may not be a set of license conditions
- Agreement should be established by the regulatory body and the operator on fulfilment of these conditions prior to starting decommissioning

Regulatory Approval Process (cont'd.)

- **The regulatory body may require a formal request to terminate the operating license upon completion of decommissioning**
- **This request may lead to an independent assessment that the decommissioning has been successfully completed upon which the regulatory body will formally respond that the license is terminated.**

Standards Supporting Documents

- **Safety Reports, Technical Report Series, TECDOCs**
- Standard Format and Content for Safety Related Decommissioning Documents (SR 45)
- Safe Enclosure of Nuclear Facilities during Deferred Dismantling (SS 26) 2003
- A Report on the Worldwide Status of Decommissioning
- Safety Considerations in the Transition from Operations to Decommissioning of Nuclear Facilities (SR 36)
- Safe Enclosure of Nuclear Facilities During Deferred Dismantling (SRS 26)
- The Transition from Operation to Decommissioning of Nuclear Installations (TRS420)
- State-of-the-Art Technology for Decontamination and Dismantling of Nuclear Facilities (TRS395)
- Record Keeping for the Decommissioning of Nuclear Facilities: Guidelines and Experience (TRS411)

Standards Supporting Documents

- Organization and Management for Decommissioning of Large Nuclear Facilities (TRS399)
- Decommissioning of Small Medical, Industrial and Research Facilities (TRS 414)
- Safety Considerations for Research Reactors in Extended Shutdown (TECDOC 1387)
- Planning, Organizational and Management Aspects of Decommissioning: Lessons Learned (TECDOC 1394)
- Decommissioning Techniques for Research Reactors- Final report of a Coordinated Research Project 1997-2001 (TECDOC 1273)
- Methods for the Minimization of Radioactive Waste from Decontamination and Decommissioning of Nuclear facilities (TRS 401)

IAEA Publications
http://www-pub.iaea.org/MTCD/publications/series1.asp

Current Focus

- **Finalisation and implementation of safety requirements**
- **Revision of safety guides, and new guide on safety assessment for decommissioning**
- **Development of supporting documents**
- **Technical assistance on development legal and regulatory framework in MSs**
  - **Serbia and Montenegro, Phillipines, etc.**
  - **Georgia - planned**
- **International Conference on Decommissioning – Lessons Learned – 11-15 December 2005, Athens, Greece**
- **Coordination with international organisations – e.g. NEA, ICRP**

Summary

- Legal and regulatory framework to cover all aspects related to decommissioning
- Different regulatory approaches
- Importance of
  - Clear requirements and criteria
  - Allocation of responsibilities
  - Adequate and effective mechanisms for regulatory control of compliance with safety requirements and criteria
- IAEA assistance
  - Standards development
  - Technical support to Member States on applying these standards in national regulations and implementation in practice