Decommissioning of Nuclear Facilities

The Decommissioning Process

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Lesson Objectives

- Define specific decommissioning terms
- Understand the decommissioning process
- Review the various decommissioning strategies
- Discuss the overall decommissioning process

Decommissioning

The administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a nuclear facility.

Decontamination

The complete or partial removal of radioactive substances or material from surfaces or from within a system or item.

Dismantlement

The disassembly or demolition and removal of any structure, system or component during decommissioning.

Decommissioning Objective

Removal of the radiological and non-radiological hazards associated with the operation of a nuclear facility or system that will allow the facility to be released from regulatory control; and protect the worker, general public and the environment during the process.
Why Decommission?

- Governmental policy change
- Uneconomical operation
- Safety issues
- Obsolete technology
- Programme completed
- Accident or unplanned event

Decommissioning Strategies

- Immediate dismantling
- Deferred dismantling
- Entombment

Immediate Dismantling

- All radioactivity above specified levels is removed
- Allows clearance or unrestricted use
- Normally begins very soon after shutdown (2 - 5 years)
- Allows use of current work force
- Work force remains relatively stable during period
- Does not allow for significant decay of radionuclides
- Waste and spent fuel management facilities must be available
- Funding must be available to complete the activities
- Preferred option if resources are available

Deferred Dismantling

- Facility is placed into long-term storage
- Dismantling is deferred from 10 to 60 years
- Systems are drained, waste removed & areas secured
- Allows decay of radionuclides
- Lose current work force knowledge
- Portions of the site may be used for other purposes
- Option if waste disposal or spent fuel management facilities are not available
- Allows for the collection of funds
- Work force reduced until dismantling begins
- Spent fuel may be an issue
- May be the preferred option if multiple facilities are on-site
- Sometimes called Safe Storage or Safe Enclosure

Entombment

- Radioactivity encased on-site
- Controlled area is reduced in size
- Remaining structure must be monitored and maintained
- Becomes a waste repository
- May be the preferred option for Member States with only a research reactor and no waste disposal facilities

Factors Affecting the Strategy Selection

- Governmental policy, laws and regulations
- Availability of waste management system
- Safety assessment of the hazards
- Availability of funding
- Physical status of the facility
- Availability of experienced staff
- Future use of facility or site
- Type of facility and residual activity
- Social and economic impact
Overall Decommissioning Process

Facility Stage
- Final Decommissioning Plan
- Final Safe Enclosure Plan & Prepare Shutdown Plan
- Source Term Reduction & Waste Conditioning
- Prepare Site Preparation Plan & S&M Plan
- Decontamination & Dismantling Phase
- Surveillance & Maintenance Phase
- Preparation Phase
- Initial Decommissioning Plan
- Update Final Decommissioning Plan
- Preparation Phase
- Operations Plan
- Finalized Site Preparation
- Source Term Reduction
- Decontamination & Dismantling Phase
- Surveillance & Maintenance
- Initial Decommissioning Phase
- Project Completion Plan
- Final Safe Enclosure Plan
- Source Term Reduction Plan
- Decontamination & Dismantling Phase
- Surveillance & Maintenance Phase

Facility Transition
- The time period between facility shutdown and implementation of the decommissioning strategy
- Part of operational phase
- Remove spent fuel, sources and operational radioactive waste
- Drain systems and process liquids
- Characterization survey completed
- Final decommissioning plan submitted to regulatory body for approval

Implementation of the Strategy
Immediate Dismantling
- Preparatory Phase
- Surveillance & Maintenance Phase
- Final Phase
- Decontamination & Dismantling Phase
- Preparation Phase

Deferred Dismantling
- Preparatory Phase
- Surveillance & Maintenance Phase
- Final Phase
- Decontamination & Dismantling Phase
- Preparation Phase

Preparation Phase
- Activities that must be performed to place the facility into a position to implement the next phase
- Will depend on the selected strategy
- Normally begins when final decommissioning plan has been approved
- If Immediate Dismantling is the selected strategy
  - Physical Actions - Update systems, expand change rooms, new systems
  - Administrative Actions - Contract subcontractors, organize staff, prepare work procedures, buy equipment and supplies
- If Deferred Dismantling is the selected strategy
  - Physical Actions - Dismantle some minor systems, isolate areas, modify security systems
  - Administrative Actions - Reorganize staff, prepare detailed surveillance & maintenance plan

Decontamination & Dismantling Phase
- Main phase for removing the radiological hazards
- Perform decontamination and dismantling activities
- Waste management is a key issue
- Intense project management required
Implementation of the Strategy

Immediate Dismantling

Deferred Dismantling

Decontamination & Dismantling Phase

Preparation Phase

Final Phase

Surveillance & Maintenance Phase

- Ensures safe conditions are maintained at the facility awaiting dismantlement
- May last for a period of only a few months to many years
- Maintain only necessary systems to ensure safety and security
- Provide surveillance to spot deterioration
- Perform maintenance of essential systems
- Very reduced staff (normally <10)

Preparation Phase

Surveillance & Dismantling Phase

Deferred Dismantling

Final Phase

Immediate Dismantling

Deferred Dismantling

Decontamination & Dismantling Phase

Preparation Phase

Final Phase

Removal from Regulatory Control!!

Project Completed!!
Summary

- Decommissioning is an important phase in the life of all nuclear facility and must not be forgotten
- Protection of human health and the environment is the primary objective of decommissioning
- The selection of the appropriate decommissioning strategy is complex and requires serious consideration
- The decommissioning process is an orderly and proven activity and there are no reasons why decommissioning cannot be planned and implemented

References

- IAEA WS-R-2
- IAEA Safety Guide WS-G-2.1
- IAEA Safety Guide WS-G-2.2
- IAEA Safety Guide WS-G-2.4
- IAEA TRS #375
- IAEA TECDOC-1124
- IAEA Fundamental Safety Principles, DS298 – approved to be published, 2006