Safety Related Documentation for Decommissioning of Research Reactors

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Research Reactor Decommissioning Demonstration Project (R2D2P)

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Content

- **Background**
- **Stucture and content**
- **Summary**

International Atomic Energy Agency

Background

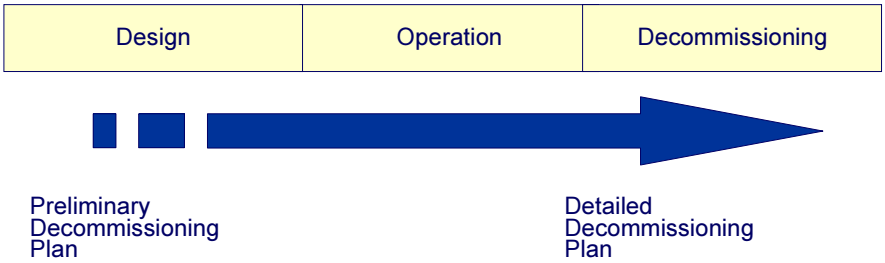
- **Decommissioning planning**
  - At design stage of facility
  - Reviewed and updated during operation
  - Final decommissioning plan at least 2 years before shutdown
- **Decommissioning plan required**
  - To justify strategy
  - Present objectives, endpoints, activities, technologies, resources, timeframes, etc.
  - Demonstrate safety
  - Demonstrate achievement of objective and endpoints

Stages in a Facility Lifetime

Facility Stage	Design, Construction & Start-up Phase	Operating Phase	Shutdown	Safe Enclosure Preparation	Safe Enclosure Period	Final Phase
Decommissioning Activity	**Initial Decommissioning Plan**	**Update Decommissioning Plan** Finalize Safe Enclosure Plan & Prepare Shutdown Plan	Source Term Reduction, Defueling & Waste Conditioning Prepare Site Preparation Plan & Surveillance & Maintenance Plan	Site Preparation & Initial Dismantling	**Update Final Decommissioning Plan** Surveillance & Maintenance	Final Dismantling, Final Survey & License Termination

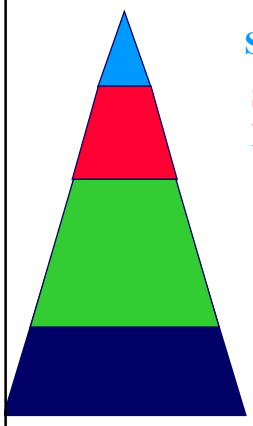
Background (cont.)

- Preliminary and detailed plans
- Graded approach
- Review and update



Background (cont)

IAEA



Safety Fundamentals (111-F)

Safety Requirements "Decommissioning of Facilities" draft (DS333)

Safety Guide "Decommissioning of Nuclear Power Plants and Research Reactors" (WS-G-2.1)

Safety Report "Standard Format and Content of Safety Related Decommissioning Document" (SR 45)

Decommissioning Plan- Contents

- Introduction
- Facility Description
- Decommissioning Strategy
- Regulatory requirements and criteria
- Decommissioning Activities
- Availability of services, engineering and decommissioning techniques
- Waste Management
- Cost Estimate and Funding Mechanisms
- Safety Assessment
- Environmental Assessment
- Project Management
- Surveillance and Maintenance
- Monitoring
- Health and Safety
- Quality Assurance
- Emergency Planning
- Radiological surveys
- Physical Security and Safeguards
- Stakeholders involvement

Structure and Content

- Introduction (1)
  - Objectives of decommissioning
  - Purpose of the document
  - Relation to other existing or developing documents
  - Approach to development of the plan
  - Independent reviews, etc.

Structure and Content (cont.)

- **Facility description (2)**
  - **Site location and description**
    - **Population, land use, geology, hydrology, natural resources, groundwater, etc.**
  - **Buildings and systems**
    - **Above and underground**
  - **Radiological status**
    - **Contaminated systems, equipment, land (surface/subsurface soil, surface or groundwater)**
  - **Facility operating history**
    - **Authorized activities, spills, design modifications, on-site burials, previous decommissioning activities, etc.**

Structure and Content (cont.)

- **Decommissioning strategy (3)**
  - **Objectives**
  - **Alternatives considered**
    - **Immediate dismantling**
    - **Deferred dismantling**
    - **Entombment**
  - **Rationale for chosen strategy**
  - **Starting and end points**
  - **Planned use of the facility and site**
    - **During**
    - **After decommissioning**

Structure and Content (cont.)

- **Regulatory requirements (4)**
  - **Legal requirements (authorization, etc)**
  - **Radiological criteria**
    - **During and after decommissioning**
    - **Dose constraints, limits**
    - **Waste management**
    - **Discharges**
    - **Clearance of material**
    - **Site release**

mSv in a year

1

0.3

0.1

0.01

DOSE LIMIT
(per individual)

DOSE CONSTRAINT
(per source,all components)

DOSE CONSTRAINT
(per source, prolonged component)

OPTIMIZATION OF PROTECTION

EXEMPTION

Structure and Content (cont.)

- **Decommissioning activities (5)**
  - **Decommissioning approach (phases)**
  - **Description of activities at each phase**
  - **Contaminated structures and buildings**
  - **Contaminated systems and equipment**
  - **Soil**
  - **Surface and ground water**
  - **Work breakdown structure**

Structure and Content (cont.)

- **Availability of services, engineering and decommissioning techniques (6)**
  - **Decontamination**
  - **Dismantling**
  - **Waste management**

Structure and Content (cont.)

- Waste Management (7)
  - Waste streams
    - Amount
    - Types
    - Location
    - Calculation methods
  - Waste management practices
    - Criteria for segregating material
    - Proposed processing, transport, storage and disposal methods
    - Potential reuse and recycle of material
    - Discharges
    - Hazardous non-radioactive material

Structure and Content (cont.)

- Cost estimate and funding mechanisms (8)
  - Cost estimate
    - Base on Decommissioning Project Work Breakdown Structure activities and schedule
    - Activity dependent costs
    - Local craft labor costs
    - Equipment costs
    - Waste transportation & disposal costs
    - Undistributed costs
    - Assumptions
    - Contingencies
    - Cost estimate calculations
  - Sources and funding mechanisms
    - Funding collection process (Internal or External)
    - Contingecy funding

Structure and Content (cont.)

- **Safety assessment (9)**
  - Assessment framework
  - Description of facility and decommissioning activities
  - Identification and screening of hazards
  - Modeling and evaluation of hazards consequences (dose or risk)
  - Evaluation of results and identification of controls
- **Environmental assessment (10)**

Structure and Content (cont.)

- **Project Management (11)**
  - Project management approach
  - Organization and responsibilities
  - Task management organization and responsibilities
  - Safety culture
  - Experience and technical qualifications requirements
  - Training
  - Special services and technology
  - Contractors support
  - Schedules
  - Radiation protection procedures
  - Exchange of experience of decommissioning operations

Structure and Content (cont.)

- Surveillance and maintenance (12)
  - Equipment and systems requiring surveillance and maintenance
  - Schedules for surveillance and maintenance of each system
  - Replacement systems
  - Continued surveillance and institutional control (for deferred stages)

NOTE: Much greater effort if Deferred Dismantling option is the preferred decommissioning strategy

Structure and Content (cont.)

- Monitoring (13)
  - On-site programme
  - Off-site programme
  - Material for compliance with clearance values
  - Land for compliance with site release values

Structure and Content (cont.)

- **Health and safety (14)**
  - Radiation protection plan
  - Nuclear criticality safety
  - Industrial health and safety plan
  - Dose estimates
  - Contamination control
  - Optimization analyses

Structure and Content (cont.)

- **Quality Management (15)**
  - Structure of decommissioning organisation
  - Quality management programme
  - Document control
  - Control of measuring and test equipment
  - Corrective actions
  - Record keeping
  - Audits and surveillance
  - Experience, resources and qualification of staff
  - Lessons learned programme

Structure and Content (cont.)

- **Emergency Planning (16)**
  - **Organization and responsibilities**
    - **Fire services**
    - **Medical services, etc.**
    - **Emergency teams**
    - **Communication**
  - **Emergency situations**
  - **Equipment**
  - **Documentation and records**
  - **Drills and exercises**

Structure and Content (cont.)

- **Physical security and safeguards (17)**
  - **Organisation and responsibilities**
  - **Physical security programme and measures (site access control)**
  - **Coordination with local security agencies**
  - **Safeguards programme and measures - Security for special nuclear material**
  - **Consideration for changes due to decommissioning project activities**

Note: this may be a classified document

Structure and Content (cont.)

- **Radiological Surveys (18)**
  - **Baseline survey – prior to operation**
  - **Final survey – after decommissioning**
    - **Monitoring objectives**
    - **Site preparation (characteristics, grid, etc.)**
    - **Monitoring strategy and techniques**
    - **Sampling**
    - **Results per unit**
    - **Lessons learned**
    - **Conclusions on overall compliance with criteria**
- **Stakeholders involvement (19)**
  - **Public involvement (plan)**
  - **Competent authorities**
  - **Potential future users of the site**

Supporting Documents

- **Other Documents and Guidelines**
- **Characterization Plan**
- **Characterization Report**
- **Final Radiological Survey Plan**
- **Final Radiological Survey Report**
- **Public Relations Plan**
- **Final Decommissioning Report**

Documents and Records- Retain After Decommissioning

- Decommissioning Plan and amendments
- Characterization Survey Report
- QA records including QC activities
- Document Control- work plans and procedures
- Engineering drawings, photographs and videos produced through completion of decommissioning
- Manufacturing and as-built drawings for any work done to support or as part of decommissioning
- Personnel dose records
- Radiation instrumentation and survey records
- Details of abnormal events and actions taken
- Waste management records
- Final Decommissioning Report

Summary

- Early planning of decommissioning
- Development of safety related documents
  - Justification of a strategy
  - Demonstration of safety
  - Demonstration of resources
  - Demonstration of adequate management
- Confidence in the regulatory body and other stakeholders (e.g. public)
- Level detail in accordance with hazard potential

Further Information

- **IAEA Safety Standards and Publications**
  http://www.pub.iaea.org/MTCD/publications/series1.asp

- **WASSC web site (draft standards)**
  http://www-ns.iaea.org/committees/wassc.asp