Safety Related Documentation for Decommissioning of Research Reactors

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Research Reactor Decommissioning Demonstration Project (R2D2P)
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Content

• Background

• Structure and content

• Summary
**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

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**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
  - Final Safe Enclosure Plan & Prepare Shutdown Plan
  - Source Term Reduction, Decontamination & Waste Conditioning
  - Site Preparation & Initial Dismantling
  - Update Final Decommissioning Plan
  - Site Preparation & Final Dismantling
  - Surveillance & Maintenance
  - Final Dismantling, Site Survey & License Termination
Background (cont.)

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

<table>
<thead>
<tr>
<th>Design</th>
<th>Operation</th>
<th>Decommissioning</th>
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</thead>
<tbody>
<tr>
<td>Preliminary Decommissioning Plan</td>
<td>Detailed Decommissioning Plan</td>
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</tbody>
</table>

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

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<th>Value</th>
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<td>DOSE LIMIT (per individual)</td>
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<td>EXEMPTION</td>
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</tbody>
</table>

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

• 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

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

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**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