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Decommissioning Planning

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Objective

Discuss

- the decommissioning planning process,
- the key points of the planning process, and
- the importance of early planning

Work breakdown structures

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Decommissioning Planning

The operator should prepare a comprehensive **Decommissioning Plan**, DP, with purpose to document & display how decommissioning activities can be safely performed

- Successful decommissioning depends on careful and organized planning, consistent with regulatory requirements
- Ideally decommissioning planning should start already at the facility design stage and not after shutdown – one plan for each facility!

General Planning

- The extent, content and detail of the DP depends on the complexity and hazard potential of the installation
- Adequate financial resources should be available to ensure decommissioning of any nuclear facility
- Relevant facility records are critical in the development of the decommissioning plan

Decommissioning Planning - Key Elements

- Review of decommissioning strategies
- Specific studies to support selected strategy
 - ✓ Feasibility/ Cost-Benefit analyses
- Cost estimate for the work at the actual site
- Schedule for performing the work at the site
- Technical scope of the decommissioning effort
- Proper staffing and training
 - ✓ Technical / Management

Technical issues are often less critical than good management and planning

Safety and Radiation Protection are prime!

Decommissioning Planning

Three stages of planning are usually recognized:

- Initial Planning
- On-going Planning
- Final Planning



- ✓ Degree of detail will vary from facility to facility and increases from initial to final decommissioning plan (DP)
- ✓ Access to relevant facility records is a critical issue when planning for decommissioning
- Planning is an 'evolutionary process'. The DP is a 'living document'
 - The planning successively becomes more detailed, refined and definitive

STRATEGY IMPLEMENTATION

The overall decommissioning strategy to be adopted should be identified as early as possible in the planning process

Initial Planning

- An initial Decommissioning Plan should be prepared and submitted for each construction application for a new facility
- This plan would contain a lower level of detail than that which would be contained in a final DP
- Operating facilities without an initial decommissioning plan should have one prepared without undue delay

Ongoing Planning

- During facility operations, the decommissioning plan should be regularly reviewed, updated and made more substantial with respect to:
 - ✓ Facility changes, incidents/abnormal operating events
 - ✓ Regulations and government policy
 - ✓ Technological advances
 - ✓ Cost estimates and financial provisions
- Also to be included into the DP are safety considerations and experience from refurbishment activities

Final Planning

- At final shutdown of the facility, the operating organization should initiate detailed studies and finalise planning for decommissioning
- The operating organization should submit an application for decommissioning including a final DP for review and approval by the regulatory body
- The DP may be amended or refined as the decommissioning proceeds

Final Planning

- If phased decommissioning - the operator should supply the regulatory body with a description of:
 - ✓ The proposed surveillance and maintenance program
 - ✓ The existing or new systems or programs necessary for facility maintenance
 - ✓ The systems to be installed to perform deferred dismantling
 - ✓ The proposed frequency for review of the above items
 - ✓ The number of staff required and their qualifications during the deferral period

Decommissioning Planning

- The final DP should be formulated as the first step in the decommissioning process by a dedicated and complete project team
- Adequate financial resources should be available to ensure decommissioning of any nuclear facility
- For deferred decommissioning, special attention should be given to periodic adjustments for inflation, technological advances, waste costs and regulatory changes

Decommissioning Planning

Typical contents of DP - I

- Facility description and operational history
- Legal and regulatory requirements
- Radioactive and toxic material inventory
- Assessment and selection of decommissioning strategy (safety, wastes, doses, costs, funding, justification)
- Project management (including organization, monitoring, review, training, reporting, records)
- Decommissioning activities (phases, work packages, decontamination, dismantling, waste management, surveillance & maintenance)

Decommissioning Planning

Typical contents of DP - II

- Safety assessment (doses, ALARA; monitoring, ... protection and emergency systems; physical security & material control; risk analysis → safety management & functions, justification)
- Radiation protection and Safety programme
- Waste Management (important!)
- Release criteria measurement/verification methods
- Environmental impact assessment
- Quality assurance programme

Decommissioning Planning

Typical contents of DP - III

- Details of the estimated costs and source of funding
- Continued surveillance and maintenance (**deferral**)
- Future decommissioning activities (**deferral**)
- Final radiation survey proposal
- Outline of final decommissioning report

Waste Treatment is important

- The **waste management plan** is an integral part (or an associated document) of the overall decommissioning plan.
- Various treatment systems may be required
 - Solidification, Removal of water
 - Immobilization of the contaminants
 - Preparation for subsequent treatment
 - Reduction of waste volume
 - Purification of water for reuse/discharge
 - Separation of a contaminant from a bulk matrix

Other supporting Documents

- Characterization Plan
- Characterization Report
- Public Relations Plan
- Final Survey Plan
- Final Survey Report
- Final Report for the Decommissioning Project

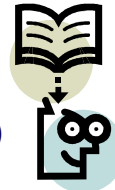
Records – The Planning Basis I

- Records guide the decommissioning process from the start of planning, through decommissioning and then serve as a record of the decommissioning
- Records are also critical for
 - Accidents and liability issues
 - Institutional records
 - Provide lessons learned
 - Facilitate information exchange
- Various equipment and systems for records management and control are available



Records – The Planning Basis II

- Never too early for compiling key decommissioning records
- Loss or lack of records (institutional knowledge) is precarious to the decommissioning process
- Inability to access records due to changes in records storage technology (long term issue)
- Keep duplicate records in two separate secure locations



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Some Common Problems

- Different
 - ✓ fabrication technique & materials of construction
 - ✓ radiological conditions and/or other hazards
- Inaccurate drawings
- Accessibility
- Procedure deficiencies
- Operator 'workarounds'
- 'Temporary modifications'

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Unexpected occurrences or accidents

Removal of fuel (loss of cooling, dropped elements, criticality)

Survey of Radiation (high radiation field, malfunctioning of equipment & monitoring instruments)

Decontamination (fire in solvent, rupture of vacuum filter bag, spillages, loss of essential services)

Dismantling & removal of concrete (loss of containment, cutting accidents, inadequate mechanical supports, equipment failure, dropped loads, combustible waste fire, explosions of oxyacetylene)



Prepare for the unexpected!

Error reduction

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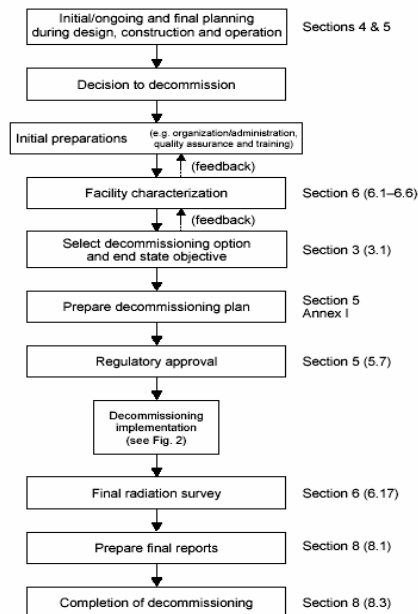
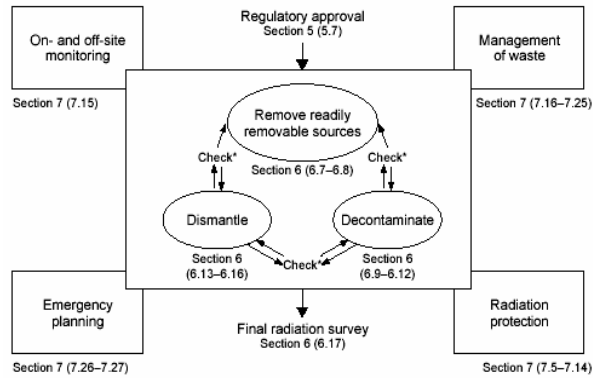


FIG. 1. Flow chart for a typical decommissioning project.

IAEA Safety Guide WS-G-2.2 DECOMMISSIONING OF MEDICAL, INDUSTRIAL AND RESEARCH FACILITIES

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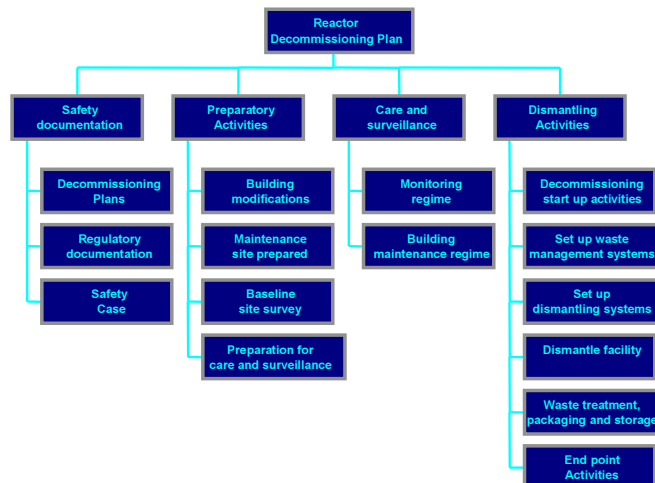
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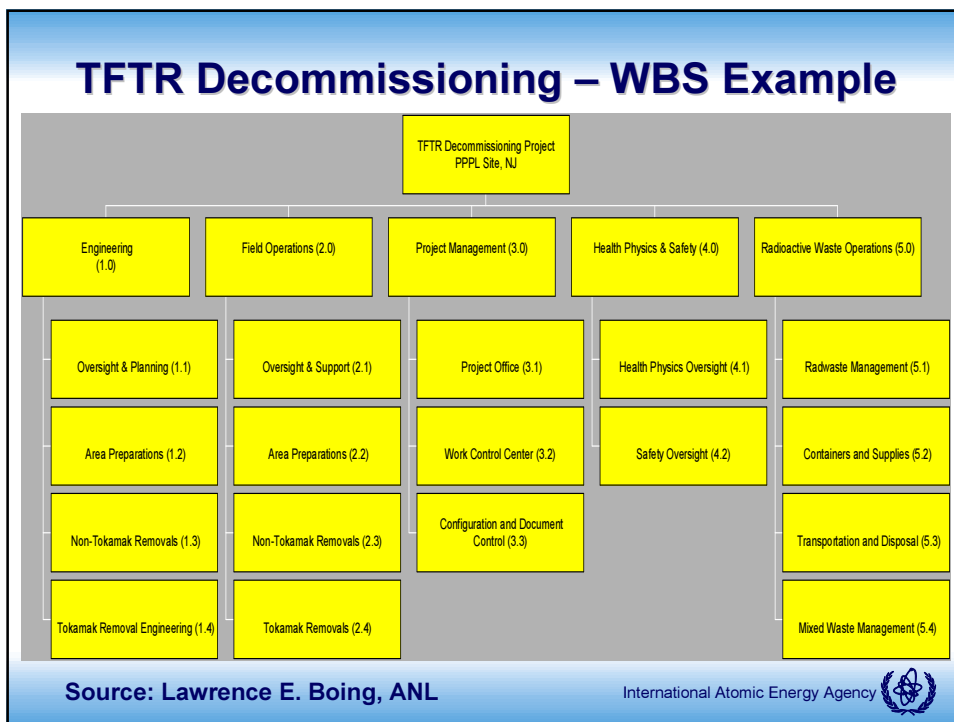
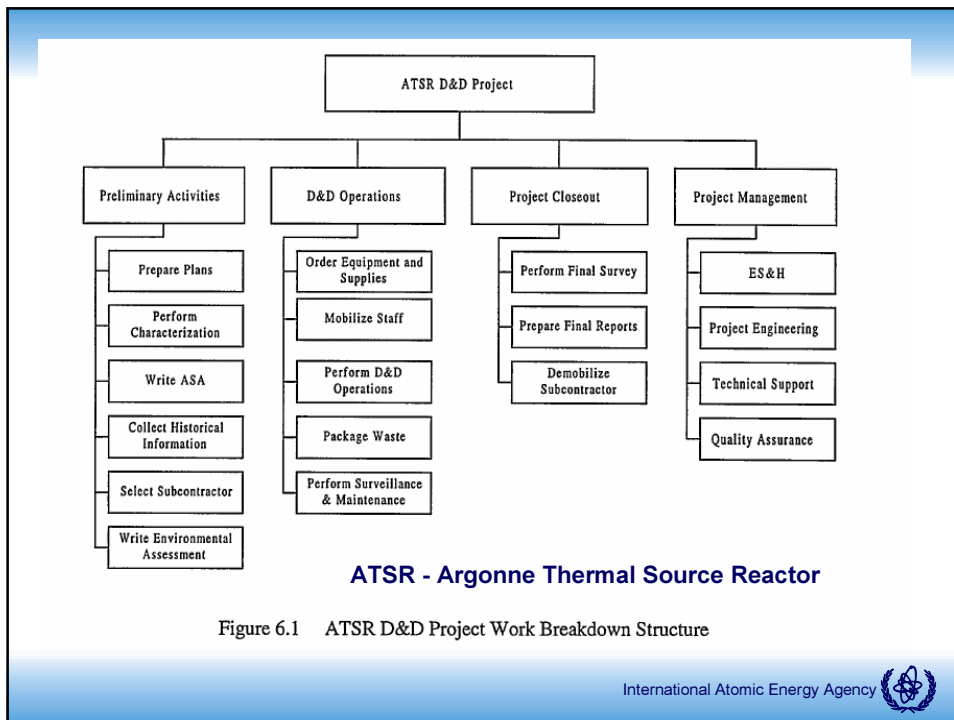


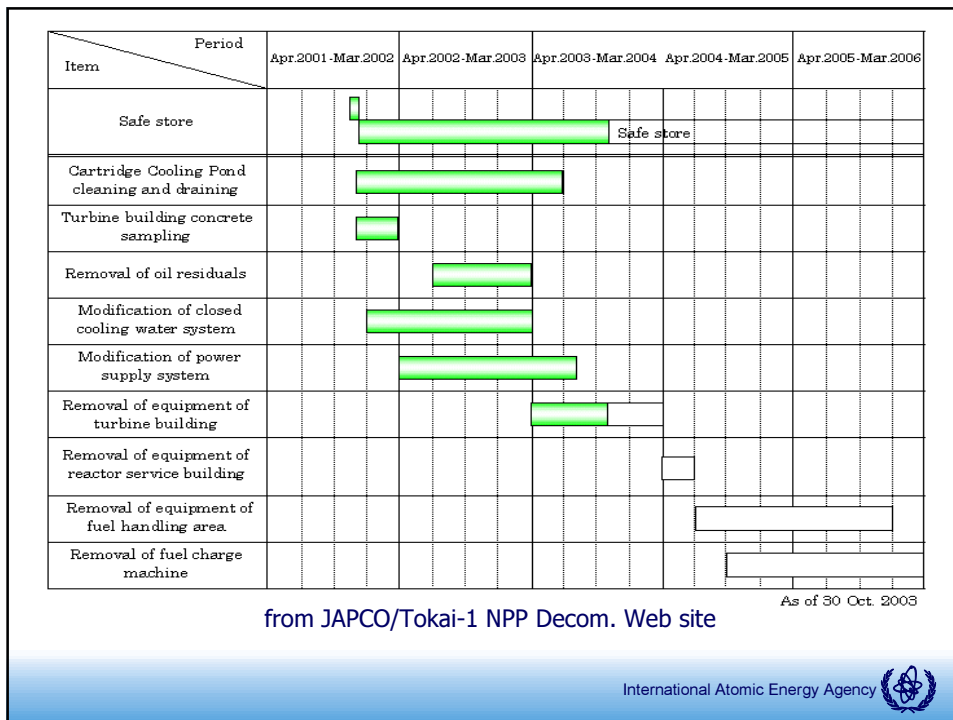
* e.g. quality assurance verification of initial characterization, appropriateness of subsequent planned steps, and status of decommissioning progress

FIG. 2. Flow chart for decommissioning implementation.

Example Work Breakdown Structure







Cost Elements

Standardised List of Cost Elements (NEA / EC / IAEA)

- 01 Pre-decommissioning actions
- 02 Facility shutdown activities
- 03 Procurement of general equipment and material
- 04 Dismantling activities
- 05 Waste processing, storage and disposal
- 06 Site security, surveillance and maintenance
- 07 Site restoration, cleanup and landscaping
- 08 Project management, engineering and site support
- 09 Research and development
- 10 Fuel and nuclear material
- 11 Other costs

also...Labour, Capital Equipment and Material, Expenses, and Contingency.

<http://www.nea.fr/html/rwm/reports/1999/costlist.pdf>

References

- IAEA Safety Guide WS-G-2.1
- IAEA Safety Guide WS-G-2.2
- IAEA Safety Guide WS-G-2.4

- IAEA Technical Reports Series #351
- IAEA Technical Reports Series #375
- IAEA Technical Reports Series #399
- IAEA Technical Reports Series #411

Summary

- Planning for decommissioning should be an on-going process, not a feared process
- The entire decommissioning process should be well planned and the roles of various parties should be clearly defined
- Numerous useful IAEA reference documents are available – use them!

Early and good planning makes dividend later!