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Interface between Operator, Regulatory Body and the Public

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IAEA Regional Workshop: Legal and Regulatory Aspects
of Decommissioning of Research Reactors
Manila, Philippines, 26 -30 June 2006

Objective

- Regular interface between operator, the regulatory body and the public during transition, decommissioning and site release period
- Some examples from the regulation of decommissioning of research reactors and other facilities

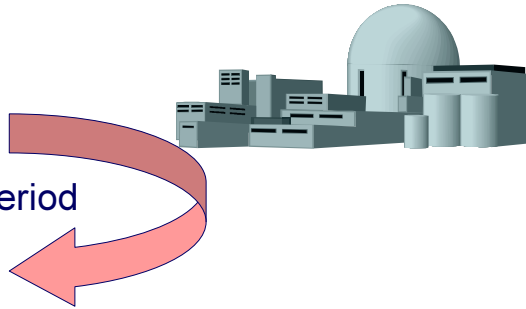
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Decommissioning is/was ideally addressed during all the stages of a nuclear facility:

- Construction
- Operation
- Closure
- Dismantling
- Site release
- Waste Management & Disposal



Transition period

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Decommissioning considerations in the **Design and Construction** phase:

- Choice of material (steel in tube ports & inserts, purify graphite)
- Construction (e.g. avoid embedded piping, proximity to concrete, provide leak detection, minimize leaking neutrons)
- Good documentation (photos, drawings, materials data)
- Measurements of neutron flux at strategic positions in the bio-shield (minimize intrusive testing)
- Requirement of decommissioning plan and updating procedures



Requirements in regulations or authorized on a case-by-case basis

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Decommissioning considerations in the **Operational phase:**

- Safe operation (within operating limits, contamination control, safety culture, keep radiation doses ALARA)
- Effective operator and maintenance training
- Frequent & adequate radiological monitoring, decontamination
- Periodic sampling of materials (spot neutron streaming)
- Configuration control, record-keeping, tracking neutron exposure variations
- Funding of back-end activities (decommissioning, waste management & disposal)
- Periodically updating decommissioning plan

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- For many existing research reactors, decommissioning was not fully accounted for during design, construction and operation
- At **Closure** (technical & economical reasons, accident) the planning process will then be even more important than otherwise
- The **Transition phase** from operation to implementation of decommissioning strategy deserves extra attention
- IAEA Safety Requirements: Safety of Nuclear Power Plants (NS-R-2) (2000)
- IAEA Safety Requirements: Predisposal Management of Radioactive Waste, Including Decommissioning (WS-R-2) (2000)

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continued....

- IAEA Safety Guides: Decommissioning of Nuclear Power Plants and Research Reactors (WS-G-2.1) (1999)
- IAEA Safety Guides: Decommissioning of Medical, Industrial and Research Facilities (WS-G-2.2) (1999)
- IAEA Safety Reports Series : Safety Considerations in the Transition from Operation to Decommissioning of Nuclear Facilities No. 36 (2004)
- IAEA Record Keeping for the Decommissioning of Nuclear Facilities: Guidelines and Experience, Technical Report Series No. 411 (2002)
- IAEA Transition from Operation to Decommissioning of Nuclear Facilities, Technical Report Series No.420 (2004)
- IAEA Safety Report Series: Safe Enclosure of Nuclear Facilities During Deferred Dismantling No. 26 (2002)



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Typical **organisational and administrative activities** in the transition phase:

- Changes to structure of licensee's organisation (decommissioning project team & manager)
- Establishment of clear **interfaces with interested parties, including the public**, information exchange mechanisms
- Preparation of final decommissioning plan
- Collection and retention of important records and record keeping system
- Development & selection work on dismantling techniques and equipment
- Communication with regulatory body, public, etc...



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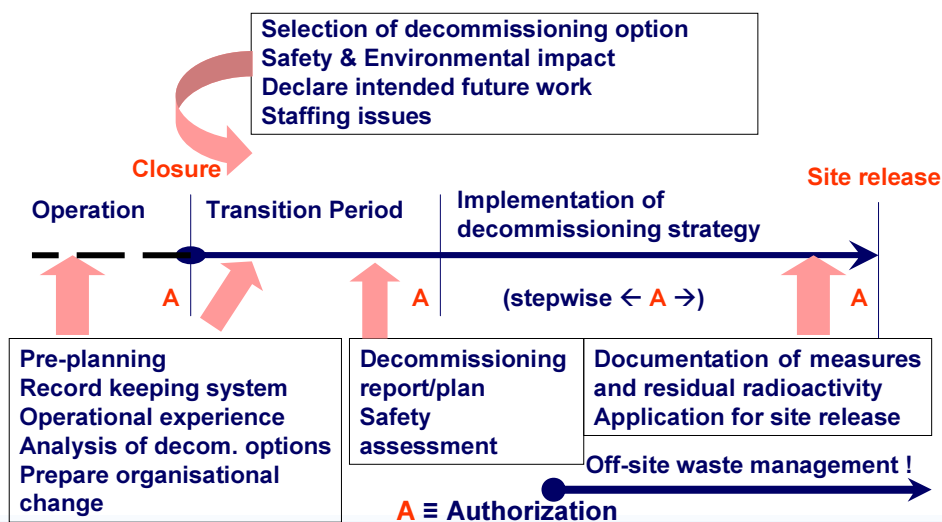
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Licensing during the transition phase:

- Authorization dependent on the processes and requirements established by the Regulatory Body (e.g. one or several stages, for specific support activities [safety systems, waste facilities...])
- IAEA safety standards require pre-review and pre-approval of decommissioning activities during the transition period (decommissioning licence/plan)
- Evaluation of impact (safety & environmental impact assessment)

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Public involvement [Open, Clear, Transparent]

- U.S., EU & elsewhere: Environmental Impact Assessment, involving public hearings, is often mandatory (Council Directive 97/11/EC, 3 March 1997);
- Local community, staff – timely dissemination of correct and meaningful information, develop confidence and trust;
- Liaison committee (i.e. government & regional organizations, public, others)
- Seminars, meetings, media, web-sites, information centres, public visiting days...

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13 May, Ispra, Italy

- Annual information day to the residents in the area around JRC-Ispra
- Closed nuclear labs, two research reactors
- Decommissioning is being prepared



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Public involvement: Some possible issues of concern:

- Removal of emergency preparedness systems
- Decommissioning policy and strategies;
- Fuel & Waste management and material reuse;
- Authorised release of site and facilities;
- Long-term funding and related responsibilities;
- Framework for safety regulation of decommissioning;
- Social dimensions, public and political relations;
- Decommissioning techniques (is waste incineration or melting used, any releases)

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Deferred dismantling (Inadequate funding and/or legal and regulatory framework, lack of waste management system, small nuclear programme)

- Radiological survey / minimise source-term
- Place the facility in a stage of safe enclosure (plant and system changes)
- Update plant and system records (data, drawings, photos)
- Surveillance and maintenance programme
- **Actively prepare** final decommissioning work!
- Address, as needed the issues of funding, amendment of legal & regulatory frame-work and waste management system

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Regulatory issues if **deferred dismantling**:

Decommissioning stages, time plan, funding

Clear management and sufficient knowledgeable staff

Review and authorize:

- structural changes and operational systems (to be kept)
- safety assessment (including physical status of facility)
- surveillance and maintenance programme (record keeping)

Close contact with the operator is important (meetings, regular inspections, status reports). Address, as needed:

- Funding situation (national or international)
- Amendment of decommissioning legislation/regulations
- Creation of waste management system

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Involvement of interested parties (public, staff, others) in case of **deferred dismantling**:

- Ensure that the public (interested parties) can comment on and influence decisions, as commensurate with national legislation
- Independent review of safety assessments (important for confidence building)
- Inform on the changing status of the facility, outcome of the surveillance and maintenance programmes and projected time plan for final decommissioning work
- Special attention: final use of site, waste issues and any existing/future on-/off-site consequences

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Entombment (a waste repository is established on site)
IAEA Safety Requirements, WS-R-1 (1999)

- Reuse of site and any remaining facilities usually constrained
- Requires a robust regulatory/legal framework
- Public consultation and possibility to influence is crucial in order to obtain acceptance for a waste repository
- Is the amount of long-lived alpha-emitting radionuclides commensurate with near surface disposal?
- International assistance in entombment planning, execution and management (e.g. IAEA)
- Use the operating personnel in implementing phase

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Of importance for the **entombment option**:

- Regulatory Body must ensure:
 - Adequate barriers over relevant time periods (100 – 300 years) are supplied;
 - Release and dispersion of radioactive nuclides is retarded and meets requirements;
 - Relevant intrusion scenarios are evaluated and compatible with acceptable, authorized risk criteria;
 - A programme for institutional control.
- Public awareness and public acceptance
- Future possible use of site

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Final site characterisation & release

- Regulatory Body shall establish criteria for site release and procedures for meeting these criteria;
- Regulatory Body & Operator must agree on the measurement methods, sampling procedures and any data on which calculations may be based;
- Interested parties should be able to have insight into the regulatory review and assessment of the site release application/process;
- Any remaining regulatory requirements must be commensurate with projected future activities at the site;
- In case of entombment or other on-site radioactive waste disposal institutional control may be applicable → **Closure**

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Confirmative site-release measurements

- ACL (U/Pu-handling laboratory, other R&D-activities) Studsvik, Sweden 1960-1998
- Dismantling 1998-2005
- Free release by SSI in 2006 (clearance levels by the European Union, RP-133, 2000)
- Building to be demolished

Source: SSI, Sweden

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Examples

10 MW experimental reactor Lucens, Switzerland (Entombment)

Rock cavern. Criticality 1967. CO₂-cooled, D₂O-moderated in graphite block.

- Accident 1969: blocked fuel channel, ruptured pressure tube;
- De-fuelling, partial dismantling 1969-1973;
- In 1988: On-site disposal review (Fill lowest caverns with concrete. Drainage system to monitor groundwater during 30 years). Regulatory permit issued December 1990;
- Step-wise work 1991 → [Remaining activity < 2,2 MBq 1992]. Waste containers to separate interim store in 2003;
- Cultural archive of Canton of Vaud (library, museum, restoration workshop, storage of cultural objects) installed in caverns.

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Examples

80 MW_{th} heat producing reactor Ågesta, Sweden (Deferred & partial dismantling)

PHWR in underground rock cavern. Operated 1963-74. D₂O-cooled & moderated



Source: Vattenfall AB / AB SVAFO, Sweden

Safe enclosure in 1975. Regular inspection and surveillance. Decommissioning plan updated 2004. Dismantling around ~ 2020.

Two steam generators dismantled and melted. Free release of waste-treatment plant in 1997.

Site outside of rock cavern used as fire brigade testing ground, for dog training, etc

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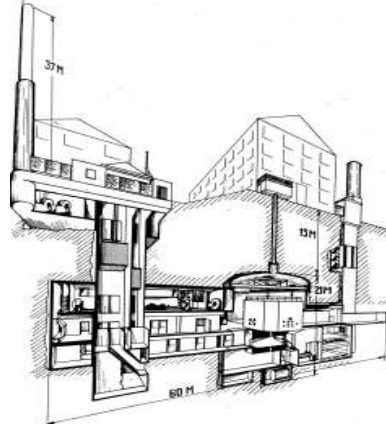
Specific examples

1 MW, D₂O research reactor R1, Stockholm, Sweden

(Dismantling complete)

Rock cavern. Operated 1954-70

- “Intermediate stage” 1970 -1980
- Dismantling 1981-1985 (Step-by-step authorisation)
- Heavy water and graphite stored off-site. Waste in shallow land-fill repository & release of metals
- Spent fuel (metallic) in interim storage pending re-processing
- Great interest in press/public due to its location in central Stockholm
- 25 persons, 140 mmanSv



Rock cavern has been used for exhibitions and film recording

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Specific examples

Research reactors R2 / R2-0, Studsvik, Sweden (Closed)

Operated 1960-2005. U.S. MTR-reactor 50 MW + 1 MW research reactor



Source: Studsvik AB, Sweden

- Closed 2005 due to economy
- Decom. strategies investigated
- Funding to be clarified
- Decom. plan presently updated
- Report to the SSI (strategy selection) in summer 2006
- Under preparation:
 - Environmental impact assessment
 - Safety assessment

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Further reading

Selection of decommissioning strategies: Issues and Factors, IAEA-TECDOC-1478 (2005)

Research Reactor Utilization, Safety, Decommissioning, Fuel and Waste Management, IAEA Int. Conf. Proc., 10-14 November, Santiago, Chile, 2003

On-site disposal as a decommissioning strategy, IAEA-TECDOC-1124 (1999)

State of the Art Technology for Decontamination and Dismantling of Nuclear Facilities, IAEA Technical Report Series No. 395 (1999)

Safe Enclosure of Shut Down Nuclear Installations, IAEA Technical Report Series No. 375 (1995)

Summary

- It is important with regular communications between the regulatory body and the operator's corporate and site management prior to closure and throughout decommissioning operations
- Both the operator and the regulatory body should plan ahead for decommissioning
- Acceptance, confidence and efficient decommissioning operations are achieved through communication with and involvement of the public and other interested parties