Operation to Decommissioning Transition

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Transition activities occur between operation and placement of the facility in a safe and stable condition in preparation for safe enclosure and/or dismantling.

Other terminologies: Pre-decommissioning, post-shutdown, deactivation, stabilization, POCO (Post Operation Clean Out, UK)
Fig. 1 Decommissioning-related activities during the lifecycle of a nuclear power plant
Fig 2 Organizational scheme at Vandellos NPP, Spain during transition to decommissioning
Presentation focus on critical issues on

- Scope and objectives of the operation-to-decommissioning transition
- Organisation and personnel
- Strategic planning
- Management
- Communications
- Records
KEY ISSUES

- Decommissioning as part of plant’s lifecycle: no gaps, just transitions!
- Early planning: failing to plan is planning to fail!
FIG. 1. Decommissioning operations and typical durations for the ‘Deferred Dismantling’ option (The dotted line shows the ‘Immediate Dismantling’ option).
Benefits of early planning for transition to decommissioning

- To shorten length of time between shutdown and start of decommissioning activities
- To do planning systematically, with less schedule pressure
- Personnel resources (history and expertise) available while the plant is operating
- Necessary info and records readily available
- Early identification of problem areas e.g. waste characterization, management and disposal
- To reduce impact of premature shutdown
- To save time and money (no deadlocks, smooth progress)
Typical Transition Period Objectives

- Development of transition and decommissioning plans incl. specification of end points
- Expeditious start of activities to eliminate or mitigate hazards
- Max utilization of current operations knowledge, personnel and systems/programmes to reduce facility hazards
- Effective relationships among all involved parties
- Mitigation of social impacts due to organizational changes
- Reduction of surveillance and maintenance costs
- Identification of material/waste management options
Typical Transition Period Objectives (cont’d)

- Initiation of process of cultural change
- Review of budget and funding for specific projects
### Comparison between decommissioning and operational culture

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Comparison between decommissioning and operational culture (cont’d)

- Operation
- Repetitive activities
- Working environment well known
- Routine communications with external parties

- Decommissioning
- One-time activities
- Unknowns possible
- New communication requirements
Comparison between decommissioning and operational culture – Regulatory focus

- **Operation**
  - Low radiation/contamination levels may be unimportant
  - Access to high radiation/contamination areas/components unlikely, rare or for a short time
  - Average amounts of materials checked/released after clearance
  - Stable isotopic composition

- **Decommissioning**
  - Low radiation/contamination levels are important (clearance)
  - Access to high radiation/contamination areas/components routine and for extended periods
  - Large amounts of materials checked/released after clearance
  - Isotopic composition changing with time
No-Action Factors

- Nuclear facilities “in limbo”, e.g. lack of assurance on time and mode of shutdown/decommissioning, permanent shutdown not stated officially
- No timely allocation of funds
- Prestige status
- Lack of decommissioning-oriented regulations e.g. operator vs regulator’s role
- Lack of qualified staff
- Lack of cultural change, poor motivation and low morale (e.g. operation team of researchers)
- Unemployment concerns, working yourself out of a job
- Perception of low priority
No -Action Factors ( cont’d)

- lack of decommissioning/waste management technologies and other infrastructure
- lack of safety culture, underestimation of hazards
- poor involvement of stakeholders, lack of consensus, over-centralization
- unfocussed assistance by donor countries
Factors relevant to the impact of transition/decom on human resources

- required organization and expertise
- staff reduction profile
- use of operating staff to undertake decommissioning project tasks
- sharing key resources among plants
- policies for choosing what work will be contracted
- early retirements
- social compensation
- key issue 1: the best people will leave early and take their knowledge with them (options: records, incentives, briefing sessions)
- key message 2: personnel management on an individual basis
“Fenwick, while I’m away I’m putting you in charge of the plant.”
Caorso NPP (Italy), Staff reduction profile
Staff and contractors profile during Wuergassen D&D

![Graph showing the number of staff, external staff, and total staff from 1994 to 2001. The graph indicates a decrease in plant staff from 1994 to 1996, followed by an increase until 2001. The external staff shows a steady increase throughout the years. The total staff line also shows an increase over the years.](image-url)
Fig. 4a: Staffing trend during transition, safe enclosure, and dismantling.
Fig. 4b: Staffing trend during transition to immediate dismantling.
Major factors in transition activities

- Allowable under an Operating License
- Typical tasks that would occur as a part of routine nuclear facility operations
  - Housekeeping
  - Waste removal
  - Decontamination
  - Work area radiation surveys
- No irreversible actions are normally allowed - reduce risks and reduce costs
- Stakeholders’ involvement in preparation to decommissioning
FOCUSSED vs FLEXIBLE REGULATIONS

The application by analogy to transition and decommissioning of regs or admin procedures originally intended for other purposes results in convoluted approach, ambiguous interpretation and unnecessary delays.
STAKEHOLDERS

- Regulatory Authorities - nuclear safety, radiation protection, transportation, environmental protection
- Local, regional and national governments
- Funding bodies
- General public- communities, interveners/pressure groups
- Employees
- Labour unions
- Shareholders
- Contractors
- Waste management organizations
"I hope it’s not too much of an inconvenience, but I am desperate to hold on to good employees."
STAKEHOLDERS (cont’d)

- Nuclear and non-nuclear industry
- National standards groups, professional societies
- International organizations
Typical Activities during the Transition Period

- Records review and archiving
- General work areas clean-up
- General decontamination
- Radiological controls
- Ventilation system requirements
- Fire and flooding protection
- Utility isolation - water, electric and security
- Systems draining
- Structural stability
- Nuclear material removal
- Facility scoping surveys
- Review status of decommissioning funds
In preparation for shutdown, post-shutdown and eventual decommissioning, it is necessary to start early on the assembly of all pertinent records in a central location (backup, media aspects).

There will be two broad classes of records: those that will need to be transferred to the decommissioning organization and those that can be archived at this time.

Decommissioning-oriented records should be identified well before final shutdown (the “flagging” option).
General Work Areas Clean-up

- Over time work areas may tend to accumulate loose items in different areas
- By performing this work now there may still be some knowledgeable staff available to assist with the optimization of this process
- Long neglected areas and equipment should be given special attention
- There is a tendency for researchers and operators to store rather than dispose of old equipment, excess material and spare parts
- Some equipment and other items that are able to be released should be cleaned out of these areas and others appropriately tagged
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General Decontamination

- Larger areas with higher levels of contamination may be decontaminated using surface flushing to facilitate future surveillance and maintenance and to assist with radiological controls in these areas.

- Various systems may require clean-out and flushing depending on hazards present, benefits gained and how these relate to required post-operational surveillance and maintenance activities.

- Consideration should be given to chemical hazards posed to workers from decontamination agents or compliance with environmental regulations and/or permits.
General Decontamination (cont’d)

- Cost/benefit analyses should be used (focussing on waste volumes generated) as well as the future need to access various areas to determine areas that should be considered for decontamination and methods to be used for these areas.

- Unless significant controlled area size reductions can be achieved, it may be more prudent to focus on general decontamination only.
Radiological Controls

- Various controls may be necessary to limit opportunities for contamination spread and to minimize the possibility for contamination migration
  - Bird and animal proofing to eliminate the possibility of contamination spread
  - Use of various sealants and fixatives to seal or fix contaminants
Cutting and sealing pipes at the bottom of Vandellos reactor
Ventilation System Requirements

- Planning should be performed for future facility ventilation needs after shutdown
  - Some areas may not need any installed ventilation - only portable units will be used in the future
  - Some areas may require use of installed ventilation periodically prior to and during entries
  - Other areas may require continuous ventilation for contamination control or temperature control
- Reduced flow rates may be possible with reductions in operations
- Consider changes to environmental monitoring
Fire and Flooding Protection

- **Fire protection** strategy should be to eliminate all fire hazards to the greatest extent possible.
- Some likely problem areas may include oils and grease hold-up in different systems and components which although emptied and flushed may still have some residual material present.
- **Flooding protection** may be a concern after shut-down depending on the geographic location and specific climate and geology/hydrology of the area.
- Some areas may require sealing or the maintenance of certain active collection, detection and pump out systems.
Utility Isolation

- Utilities routinely requiring some consideration include: water and steam systems, sanitation and sewer systems, electrical systems and security systems.
- Certain utility services to entire areas or buildings may be able to be isolated.
- Water and steam systems should be isolated and drained; sanitation and sewer systems are normally abandoned and/or removed.
- Security enhancements may be necessary including access controls if not already in place.
Utility Isolation (cont’d)

- Electrical services should be evaluated and consideration given to electrically isolating the facility - although some minimal amount of service will still be required for surveillance and maintenance activities.

- Options available include:
  - Isolate and reconfigure existing system
  - Add alternate sources of power combined with abandonment of some systems
  - Complete reliance on hand-held and portable equipment
Wire isolation at Dodewaard NPP, the Netherlands
Systems Draining

- Systems in the facility should be drained and isolated in order to:
  - Minimize presence of any potentially hazardous material
  - Minimize potential of contamination spread
  - Reduce general area radiation exposure rates
  - Utilize expertise of plant staff to perform safe shutdown
The purpose of this activity is to determine and document the adequacy of an extended non-operational period or commonly referred to as a ‘Structural Assessment’.

A tailored approach to this activity is appropriate with a level of detail consistent with the planned future use of the facility (if any) and a review of potential hazards to the workers, the public and the environment.

Periodic future inspections on some regular frequency may be warranted.
Facilities which are internally contaminated should ensure that the roof of the structure is sound and will serve its intended purpose.

Routine inspections and assessments should be made to document conditions with the passage of time until final dismantling can occur.
Nuclear Material Removal

- Safe shutdown will address existing nuclear materials on-site namely spent fuel, sealed sources and other operations related nuclear material

- This may allow the licensee to reduce associated accountability, safeguards or other security requirements

- Spent fuel should be removed and/or shipped to an ‘away from reactor’ storage facility or placed into some other approved storage mode appropriate for the national strategy for dealing with these materials
Facility Radiological Scoping Surveys

- Scoping surveys should be used to supplement the operational survey records to gain basic knowledge of the facility radiation condition.

- An extensive and intensive characterization is not appropriate at this time; information should include that gleaned from operational records, process knowledge and limited sampling and measurements.
The primary objectives of the scoping survey should be to:

- Provide data for the preliminary assessment of hazards
- Support classification of areas as contaminated or non-contaminated
- Provide input into the details characterization survey design
- Determine if hazards are present other than radiological hazards
Status of Decommissioning Funds

- Review the status of the Decommissioning Plan for the facility
- Review the status of the cost estimate for the decommissioning - should be done on a fixed period basis
- If there is no decommissioning fund then initiate discussions and get requests made for the appropriate funds from the appropriate entities
- Review availability of the funds - are there limitations in how the funds can be released
- What happens to funds left over at the completion of the decommissioning process
IAEA Guidance docs

- Transition from Operation to Decommissioning of Nuclear Installations, Technical Reports Series 420, 2004
- Safety Considerations in the Transition from Operation to Decommissioning of Nuclear Facilities Safety Reports Series 36, 2004
The most recent, comprehensive book on Nuclear Decommissioning

Nuclear decommissioning: Planning, execution and international experience

Woodhead Publishing Series in Energy No. 36,

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Summary

- There are numerous actions that can be taken prior to or during actual facility shutdown that optimize eventual dismantling
- Early planning is the key to smooth operation-to-decommissioning transition
- Planning for transition requires timely allocation of dedicated resources (human, technical, financial)
- Significant cultural and organizational changes will occur during the transition period
- Availability of relevant data and records is essential
- Good communication and involvement of all stakeholders is essential