International experiences in the decommissioning of nuclear facilities

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International Forum – Dialogue and Exhibition
Atomeco 2017

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Decommissioning Nuclear Facilities

- Nuclear facilities are designed with a finite operational period.
- An idling or safe shutdown facility remains a liability, i.e. decommissioning is necessary to clean-up radioactivity and to remove / transfer the legacy liability.
- While a protracted no-action may lead a permanently shutdown facility to a hazardous situation, quick acceleration of decommissioning with a lack of planning exposes alternative dangers and risks such as a loss of stakeholder confidence, compromised safety performance, potentially increased costs and delays in the decommissioning schedule.
- Early and strategic decommissioning planning can positively influence the scope of decommissioning, project safety, costs and overall timing. Decommissioning also implies positive management actions.

Decommissioning Experiences

- ~ 17 reactors had been fully decommissioned, > 50 are being dismantled, another ~ 50 are in safe enclosure mode, 3 have been entombed.
- The total dismantling of prototype facilities (e.g. JPDR, Japan; WAGR, UK; Gundremmingen, Germany; BR-3, Belgium) demonstrated that decommissioning could be performed safely and cost-effectively.
- These projects also resulted in the further development and optimization of decommissioning techniques, i.e. some novel first-use techniques have now become routine - as applied in several US projects including Big Rock Point, Maine Yankee, Trojan, Yankee Rowe and others.
- Large nuclear fuel cycle facilities have also been dismantled (e.g. the Eurochemic reprocessing plant in Belgium).

Decommissioning Experiences

- In parallel with the growth in decommissioning technology, a decommissioning "market" has grown in many industrialized countries.
- Even a mature industry must keep pace with evolving safety and environmental regulatory requirements, technological progress, and with changes in political perceptions and societal expectations.
- There are still technical areas that are constantly being improved (e.g. use of robotic systems), and this experience and know-how should be transferred to countries that are now facing "first of a kind" decommissioning projects.
- Experience has also shown that non-technical factors (e.g. organization and management of decommissioning projects) are often more crucial to the success of a project than technological factors.

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Responsibilities & interests of parties involved

- The operating organization is responsible for all aspects of safe decommissioning of a facility,

- The regulatory body (and other competent authorities) has the responsibility to assess / monitor the compliance status of the operating organization, i.e. to ensure that safety requirements are met during all phases of decommissioning.

- The national government has the ultimate responsibility to ensure safety and environmental protection in all instances. Clear decommissioning policies and strategies, taking into account the available infrastructure and the approaches for the implementation of the policy, should be clearly defined by the national government.

Responsibilities & interests of parties involved

- Particularly important is the national legislation on segregation and collection of decommissioning funds for securing the financial resources needed to complete decommissioning.

- The end of a nuclear facility and its transition to decommissioning can have financial impacts on local communities. Understanding stakeholders' expectations of final decommissioning outcomes can improve the project planning and execution.

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Decommissioning Challenges

- A large number of nuclear facilities are reaching the end of their design life in the coming decades, i.e. an increased need for decommissioning and radioactive waste management.
- Some countries have to manage legacy waste (& waste sites) from historical nuclear activities.
- Countries without a national policy and an adequate legal and regulatory framework to guide nuclear decommissioning may experience delays.
- A lack of dismantling, decontamination and remediation technologies and supporting infrastructure in some countries may hinder decommissioning.
- Limited in-country decommissioning project management expertise, and lack of societal and stakeholder support may also lead to project delays.

Key elements in a successful decommissioning project

- Early development of a decommissioning plan, acceptable to both the regulator and achievable in terms of activities and cost.
- Apply existing knowledge & techniques available and select the most cost-effective approach; noting that the decommissioning approaches vary in each project.
- Protect the public, workforce and environment in planning / executing decommissioning (no less important than the operational phase).
- Achieve safety via proper analysis of surveillance results, maintain up-to-date safety documentation that reflects current project status.
- Clear understanding of the costs and their uncertainties are important in decommissioning planning, i.e. standardized decommissioning cost models such as ISDC can be useful.
- Utilize existing plant operations staff to achieve safe and efficient decommissioning.

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Conclusions

- Nuclear facilities can be decommissioned safely, cost-effectively, and with no adverse impact to man or the environment.
- Early decommissioning planning, with clear regulatory guidance and regulations specific to decommissioning will reduce the costs of decommissioning and risks.
- Effective stakeholder engagement is crucial to gain trust and support in executing a decommissioning project.
- International cooperation, independent peer reviews, continual exchange and dissemination of innovative decommissioning technology worldwide are efficient means for sharing know-how and improving safety.

Future Trends

- Many new nuclear facilities are now designed with decommissioning in mind. Designing and planning for decommissioning shows understanding of decommissioning requirements and the costs involved.
- More countries are considering nuclear decommissioning as a redevelopment and reuse project, rather than aiming at final disposal of radioactive waste and greenfield restoration.
- The trend towards brownfield sites and prompt site redevelopment will grow in the future because of economic factors and the practical impossibility (or the prohibitive costs) to reach pristine conditions at heavily contaminated sites (e.g. legacy waste sites).