Transition from Operation to Decommissioning

Outcomes of the CDLM-5 Topical Session

Background

The Nuclear Energy Agency (NEA) Committee on Decommissioning of Nuclear Installations and Legacy Management (CDLM) was created in 2018 following a request from NEA member countries to enhance NEA focus on nuclear decommissioning and the remediation of legacy sites. The creation of the CDLM reflects the NEA goals of providing governments and other interested stakeholders with authoritative and reliable information on the political, strategic, regulatory and social aspects of decommissioning activities and the management of legacy and complex sites.

The NEA CDLM addressed the subject of the "Transition from operation to decommissioning" in a topical session during its fifth plenary meeting on 24 March 2023. The session was structured in two parts:

1. Presentations from four different perspectives: those of the regulator, operator and civil society as well as the international perspective.
2. Plenary discussion.

This document summarises the key findings.

Objectives

The transition from operating a nuclear facility to implementing the dismantling phase is a pivotal period for every decommissioning project. It entails a series of organisational and technical modifications to adapt the facility and workforce to meet new objectives and requirements. A comprehensive plan encompassing various activities is essential to support this transition and adequately prepare for the dismantling of the facility. This includes identifying and assembling a team well before the transition period with expertise in dismantling, site characterisation, radiation protection, planning, stakeholder engagement, waste management and other areas. Retaining or recording knowledge is essential, as is ensuring that staff with the skills needed to deliver the decommissioning project safely and efficiently are attracted and retained.

This transition phase has been addressed as a topic several times in various international publications and activities before, but there are still lessons to be learnt for the relevant stakeholders. This topical session aimed to facilitate discussions between the different stakeholders with respect to the various aspects of transitioning.

Summary of the presentations and discussions

1. A regulator's perspective

The first presentation was provided by the Institut de Radioprotection et de Sûreté Nucléaire (the French Institute for Radiological Protection and Nuclear Safety, or IRSN). The presentation began with an introduction to the licensing framework related to the permanent shutdown of a nuclear facility, which clarifies the life stages of nuclear facilities for decommissioning and associated requirements. In France, transition activities are typically performed under the operating licence. A graded approach for managing modifications during the transition period is allowed and provides a good basis for establishing the kind of activities that could be performed during the transition. According to the regulatory framework, there is a mechanism for managing modifications to a facility during the operation. For example, there are three levels of

modifications: non-significant, significant and substantial. If a facility owner wants to do substantial modifications which would affect safety, approval from the regulatory body is required and could lead to changes in the licence conditions or in the licence itself. Those activities cannot be performed until the request is granted by the regulatory authority. Such a regulatory framework is fully applicable during the transition because the nuclear facility is still under operation. This is one reason why the scope of activities that can be performed during the transition period is limited.

Transition activities in France should not exceed ten years. The timeline of the regulatory framework for submission and review is fixed for the operator, the regulator and the publication of the decommissioning decree. The facility operators must notify the regulatory authority of the planned shutdown and anticipated transition dates and timelines. The final shutdown notification must be supported by an update of the decommissioning plan (DP). The DP includes descriptions of the preparatory operations for dismantling, the modifications envisaged, the main equipment required for dismantling, the waste management routes, the planning state and the end state. The operator must also explain how the envisaged preparatory measures for dismantling remain within the framework established by the authority that issued the operating decree and the associated safety framework. Activities that will be carried out during the transition period must be defined in the DP that supports the notification of permanent shutdown. Preparatory decommissioning activities can be implemented during the transition period. Transition activities, supported by safety cases, are limited to final actions (e.g. removal of hazardous substances or characterisation), preparation (preparation of decommissioning actions including training personnel and modifications to infrastructure), and dismantling activities (only a limited number of irreversible dismantling works are authorised on a case-by-case basis). The construction of new equipment, facilities or infrastructure to support decommissioning can be envisaged under specific conditions during the transition period.

The French regulatory system uses milestones as key performance indicators that could be included in a decommissioning authorisation. These milestones can include clear definitions of what will be done at each step/phase and what the state of the facility will be before and after the dismantling step/phase, with appropriate flexibility. The regulator will oversee the proper implementation of these milestones during decommissioning.

Additional insights on regulatory framework and key aspects to consider during the transition phase can be found in the *NEA publication reparing for Decommissioning During Operation and After Final Shutdown* (NEA, 2018).

2. An operator's perspective

The second presentation was given by Preussen Elektra (Germany). It highlighted the mindset of the nuclear business from the owner's perspective and included the different activities that are completed during operation, in a transition period and during decommissioning. It touched upon the importance of having long-term perspective and a stable strategic orientation, and how the fleetwide approach in planning for decommissioning activities could support efficient implementation of the transition period. It was noted how dismantling is not a new activity as workers are used to doing this during plant maintenance activities in the operational stage, whereas material treatment might be something new and not common during operation. The main challenges that the nuclear industry is facing now include the continuously changing environment, knowledge transfer and knowledge management difficulties. The safety culture and standard of nuclear excellence must also extend from the construction and operational stages into decommissioning. Key success factors to address some of the challenges and shorten the transition period include: addressing change early, creating and maintaining stable conditions, motivating and empowering staff, doing the hard activities first, using the learning curve effect and bundling tasks.

Other topics covered include the use of key performance indicators for evaluating not only one project but also improvements between each project. From the operator's internal point of view, transferring knowledge from one site to another can be a challenge. For example, during the operational stage, staff focus on good performance at their own site, with limited inter-facility information exchanges. By contrast, when a contractor is hired to handle decommissioning activities for a fleet of facilities, the contractor will pay close attention to performance improvements and the learning curve from site to site and create synergies to ensure contracting milestones are met. When there are regulatory milestones, they can be seen as key performance indicators and can be a helpful tool for operators to measure and report the progress of the transitioning process both externally and internally.

A graded approach could also be helpful for the transitioning process, given that there is a lot of uncertainty during the transition period. Most operators are setting milestones and committing to work on decommissioning, but the question is how to handle the current situation, which is dynamic from the viewpoint of shifts in energy production. For example, the United States has been discussing bringing back nuclear power plants that have been shut down. Considerations will need to be made regarding the possibility of restarting nuclear power plants that have been shut down or were planned for decommissioning. From the operator's point of view, restarting shut down nuclear power plants can be challenging because the facilities no longer have licences and applying for new licences could pose a new challenge. A few examples of the challenges are highlighted below:

a. Although the prolonged operation of nuclear power plants is financially positive for the operators, operators will have to deal with the decommissioning contracts that have been signed beforehand.

b. The limitations of national regulation could pose a challenge. For instance, in Sweden's current framework, once a nuclear power plant is permanently shut down it cannot be restarted. Given the recent energy crisis in Europe, there are proposals in place to restart nuclear power plants. Nevertheless, nuclear power plants have spent several years preparing for decommissioning and the resources spent thus far could make the decision to restart the nuclear power plants harder. That said, it is theoretically possible to restart the plants to address the energy crisis. This requires that the business case is positive. This means that the effort involved in recommissioning and the proceeds from energy generation should be advantageous for the operator.

3. A civil society perspective

The third presentation was delivered by the chairman of the San Onofre Community Engagement Panel (United States). The presentation emphasised the need to use two-way communication when engaging with the community in order to listen to and learn from the concerns of stakeholders. For example, the community's interest may be hard to predict initially as the public may not only be focused on the loss of jobs at the plant but also on how the local community schools, businesses and infrastructure will be impacted by decommissioning activities and eventual plant shutdown.

It is important to identify what meaningful, consent-based and transparent engagement looks like to all parties. To get a wide range of perspectives, the diversity of people engaged should first be made central, which really depends on the rules of the panel and the process. Taking into account the voices of many communities – including tribes and Indigenous communities – is crucial. Finally, understanding how disagreements will be addressed is important.

In addition, when communities are involved, transition can become a highly political issue and plant operators might have to shift away from thinking about how to "optimise" the process (like an engineer), and instead pay attention to what is essential for safety and being responsive to community concerns, among other things.

To measure the effectiveness of stakeholder communications, surveys among the panel could be used. A lot of performance cannot be measured objectively. Learning from the experience of communities in Canada, Finland and Sweden will be helpful.

4. International perspective

Representatives of the World Association of Nuclear Operators (WANO) Transition to Decommissioning Industry Working Group (TTD I-WG) made a presentation on the WANO Transition to Decommissioning Roadmap published in October 2022. The TTD I-WG's main objective is to provide a forum for industry representatives to meet and identify opportunities, needs and issues and to develop solutions related to preparing a plant for decommissioning, including process optimisation, knowledge transfer from operation to post-operation staff, and common industry guidelines. To that end, the Working Group prepared a Roadmap to guide operators through the transition to decommissioning. The Roadmap's contents are grouped into five topics: strategic considerations, legal, regulatory and licensing, technical considerations, managerial and leadership issues – including cost and funding estimations. The presentation explained the key issues under each topic. Since the objective of the TTD I-WG has been met, the members decided to shift from being an industry working group to holding an annual WANO TTD workshop to collect and publish decommissioning good practices and to review the Roadmap as and when necessary.

The International Atomic Energy Agency (IAEA) briefly went over key findings from the 2022 IAEA Technical Meeting on Ensuring Operator Preparedness for the Transition from Operation to Decommissioning, held on 13-17 June 2022, and from the International Workshop on Managing Transition from Operation to Decommissioning held on 12-16 December 2022. The presentation provided key points on the meaning of "transition", licensing and regulatory approaches, managerial approaches, technical issues and the optimisation of the transition phase. The IAEA presentation also covered a number of publications that address many aspects of transitioning, from operation to decommissioning, such as the IAEA Safety Report Series No. 36 *Safety Considerations in the Transition from Operation to Decommissioning of Nuclear Facilities* (IAEA, 2004a), the Technical Report Series No. 420 *Transition from Operation to Decommissioning of Nuclear Installations* (IAEA, 2004b), the NEA publication *Organisational Capabilities for Decommissioning Nuclear Installations* (NEA, 2022), the "Position Paper on Principles for Developing the Transition from Operations to Decommissioning" (ENISS, 2022) and the WANO Roadmap (WANO, 2022).

Following the presentations, the panel discussion highlighted the following key elements:

- From the international perspective, the transition process cannot be completely standardised for each country as every country has its specific circumstances. Countries might exchange information to identify commonalities and leverage lessons learnt, e.g. how to optimise the transition phase duration and costs and avoid delays in starting decommissioning activities.
- Developing a new key performance indicator to measure the transitioning performance, including indicators for waste stream, financing and costs and safety systems, is challenging.
- There could be possibilities for further discussion on the transition and key performance indicator topics.
- Within the industry, many documents have been created by various entities such as the NEA, IAEA, and WANO, on transitioning for audiences like regulators and operators. The practical applicability of such documents to the intended audience, and the lessons learnt from the implementation, could be further examined.

Key takeaways

During the topical session, each speaker highlighted important aspects to consider when planning and executing activities during the transition period. The panel discussion session that followed also underscored key elements that will need to be well understood to efficiently and effectively complete decommissioning activities. Those key takeaways are summarised below, taking into account different perspectives.

Technical considerations

- Early planning of the modifications needed for decommissioning is important.
  - Defining plant systems that need to be maintained during decommissioning (e.g. heating, ventilation and air conditioning [HVAC] system).
  - Purchasing equipment needed for dismantling or other decommissioning activities should to be done early.
- Leveraging experience from site to site, taking into account learning curves, and bundling tasks could facilitate the efficient completion of decommissioning activities.
- Assessing and developing the right set and composition of skills is essential.

Societal considerations

- Transparency and communication are keys to success.
  - Identify what meaningful/consent/transparent engagement looks like to all parties.
  - Strive for two-way communication when engaging with the community (listening to the concerns of the stakeholders).
- It is essential to keep informed and involved and to build trust with key stakeholders.
  - Seek to understand different stakeholders' interests as there might be diverging interests that may not be obvious to all.
- The engagement process should be crafted to address dissenting voices.
  - Understand how agreements will be reached with dissenting voices.

Regulatory considerations

- It is important to have an appropriate and flexible framework and rules of engagement with facility operators.
- Involvement of the regulatory authority early in the process is advisable.
- Regulatory readiness for overseeing decommissioning activities is essential.
- The organisation's safety culture during the transition period must be maintained.

Leadership and management

- Ensuring that change management (HR strategy, transparent communication with staff) is developed and communicated with all stakeholders is essential.
- Acknowledging the cultural shift that is necessary and the preservation of knowledge is fundamental.
- Consideration for proper key performance indicators to measure the planning, execution and successful completion of decommissioning projects is important.
- Understanding the goals and milestones for the end of the transition phase is key, and makes it possible to anticipate future activities.

Financial

- It is necessary to discern which activities will be financed as being part of the "operation" and/or the "decommissioning" of a facility, and to clearly separate the financial sources, if needed.

General

- Understanding the meaning of transition, including the regulatory frameworks that are applied to this period, is important in order to devise effective and efficient processes for its implementation.
- Flexibility and agility are needed when working with country-specific frameworks.

Further reading

- ENISS (2022), "Position Paper: Principles for Developing the Transition from Operations to Decommissioning", European Nuclear Installation Safety Standards, www.eniss.eu/publications.
- IAEA (2004a), *Safety Considerations in the Transition from Operation to Decommissioning of Nuclear Facilities*, International Atomic Energy, Agency, Vienna, www.iaea.org/publications/6915.
- IAEA (2004b), *Transition from Operation to Decommissioning of Nuclear Installations*, International Atomic Energy, Agency, Vienna, www.iaea.org/publications/6823.
- NEA (2022), *Organisational Capabilities for Decommissioning Nuclear Installations*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_70244.
- NEA (2018), *Preparing for Decommissioning During Operation and After Final Shutdown*, OECD Publishing, Paris, www.oecd-nea.org/jcms/pl_15058.
- WANO (2022), "Transition to Decommissioning Roadmap", World Association of Nuclear Operators, www.wano.info/resources/white-papers-factsheets.

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