

Decommissioning and environmental remediation: an overview

By Irena Chatzis



Decommissioning staff cutting down a piece of large metal equipment at a nuclear facility.

(Photo: Sellafield Ltd/UK)

Nuclear decommissioning and environmental remediation share a common objective: to reduce radiation exposure to people and the environment at sites where radioactivity levels require restrictions in their use.

Decommissioning is a planned activity at the end of life of facilities that have a regulatory licence to conduct nuclear or nuclear-related activities. It is concerned with all the activities needed to remove them from regulatory control and thus release the site for other uses (see box).

Decommissioning

Decommissioning is a normal part of the lifecycle of almost all industrial facilities. When the facility no longer serves a useful social or economic purpose, it needs to be dismantled and the site made available for other uses.

Requirements for decommissioning should be considered during design and planning of facilities. The decommissioning plan and associated cost estimates need to be prepared in advance, to ensure that sufficient financial resources are available.

Environmental remediation, on the other hand, is concerned with reducing existing radiation exposure from land, soil and groundwater contamination that results from past activities involving the use of radioactive material for civil or military purposes (see box, next page).

Oversight to ensure safety

The objective in both decommissioning and environmental remediation is to lower levels of residual radioactivity enough that the sites may be used for any purpose, without restriction. In some cases, however, this may not be practical and restrictions may be placed on future land use. Following decommissioning, for example, some sites may be reused for non-nuclear industrial activities, but not for habitation. Some former uranium mining sites may be released for reuse as nature reserves or for other leisure activities.

Both decommissioning and environmental remediation are major industrial projects in which the safety of the workforce, the local public and the environment must be ensured from both radiological and conventional hazards. Hence, an appropriate legal and regulatory framework, as well as proper training for personnel both in implementation and in regulatory oversight are among the necessary preconditions to ensure safety.

Both the decommissioning plan and the cost estimate will evolve during the lifetime of the plant and will become progressively more detailed toward the end of the plant life.

However, such plans do not exist for several facilities constructed in the early days of the nuclear industry. In the case of these older plants, there may also be a lack of comprehensive records of the plant configuration and detailed accounts of the operational history. Such situations add additional complexity to the decommissioning process.

Radioactive waste management

A well-coordinated system for managing the wastes that arise from decommissioning or environmental remediation is another important requirement. Decommissioning generally results in the production of large amounts of material with low levels of radioactivity. Depending on the material and on national regulations, a large part of the waste may be disposed of in near surface disposal facilities compliant with international safety standards for permanent disposal. Such facilities already exist in several countries; for others the waste material has to be held in temporary storage until a long-term solution is identified.

The amount of radioactive waste involved can be reduced significantly through decontamination of the plant systems prior to their dismantling. Some countries also have facilities for recycling scrap metal, e.g. by melting. Waste with higher levels of radioactivity or long lived components will generally have to be placed in repositories located deep underground.

For environmental remediation, the quantities of waste material involved can be much larger if, for example, soil needs to be removed and subsequently disposed of as waste. Opportunities for volume reduction also exist in this case, for example by separating soil components with higher contamination levels from those with lower levels.

Environmental remediation

Environmental remediation aims to reduce radiation exposure from contaminated soil, waste storage facilities or other contaminated infrastructure, groundwater or surface water. Its purpose is to protect the people and the environment from potential harmful effects due to exposure to ionizing radiation. This may result from activities such as the mining and processing of uranium or the release of radioactive substances to the environment after a nuclear or radiological accident.

The generation of radioactive materials may also be a result of non-nuclear industries, such as oil and gas production, in which exploration and mining activities can increase the potential for exposure from naturally occurring radioactive material.

Funding

Sufficient funding is a key factor in decommissioning and environmental remediation projects, which are generally very expensive. A significant proportion of sites requiring decommissioning or remediation are state-owned and implementation costs are paid from national budgets. Often, the amount of funds allocated to environmental cleanup activities depends on the priorities of the government.

For commercial power plants, funding decommissioning is generally the responsibility of the plant's owner. The funding is usually either invested in a special fund dedicated to cover decommissioning costs or, in the case of some large utilities, are provided directly from the company's operational revenues and cash flow.

Current status

Although some countries have achieved substantial progress, many are facing significant difficulties in implementing their decommissioning and environmental remediation programmes.

Having plans in place for managing the entire lifecycle of nuclear facilities is nowadays a universal requirement for commencing new projects.



Application of a combined scheme for covering and draining uranium mill tailings.

(Photo: Wismut GmbH/Germany)

There are four major elements that need to be considered in environmental remediation:

1. The levels of radiation exposure to people that result from the contamination.
2. Reducing radiation doses and risks, making best use of the available financial, technical and labour resources.
3. Returning a site to the conditions before the event that caused the contamination may not be necessary, and is often not easily achievable anyway.
4. In many cases, the main driver for remediation is the public perception of the risks and benefits of undertaking the cleanup activity. In such situations, the overall well-being of the local community is an important factor in determining the planned final state of the site.