Decommissioning plans for TVO's new reactors

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Abstract

In new NPP projects in Finland decommissioning has gained increasingly visible role already in licensing phase. E.g. for OL1 and OL2 the first comprehensive decommissioning plan was done in 1989, about ten years after the start of operation. Now the licensee has to show the feasibility of the decommissioning already in construction licence phase and prepare a decommissioning plan when applying for operating license. The requirements for decommissioning plans are set in nuclear energy act, government decree on safety of the disposal of nuclear waste and regulatory guides of STUK.

The Finnish legislation requires the decommissioning plans to be updated in six years intervals. The latest decommissioning plan for Olkiluoto NPP was prepared in 2008. Unit OL3, estimated to start operation in 2012, was preliminary taken into account in this plan by estimating waste inventories, repository volume and long term safety analysis. OL4 which is under Decision in Principle process was also considered mainly by using data for OL3, but e.g. when considering the disposal of reactor pressure vessel (RPV) the biggest RPV of the reactor choices was applied.

This presentation summarizes main steps, in which the decommissioning has to be considered in NPP licensing in Finland as well as the main items which have been and still need to be presented for the licensing of OL3 and OL4. Also, a review on main issues to be assessed in the decommissioning plan is presented, including decommissioning strategy and plans for final disposal.

Introduction

New NPP projects are ongoing at TVO. OL3 is approaching the phase to apply for operation licence and the parliament has approved the Decision in Principle to build OL4. These projects have also included decommissioning considerations. Draft of the first decommissioning plan of OL3 has been done and will be submitted to authorities along the application for operation license. Decommissioning of OL4 has been taken into account in plans for final disposal and long term safety analysis of final disposal. Finnish NPP licensing process is shown in Figure 1.

In Finland, according to Nuclear Energy Act, *decommissioning means the dismantling of a finally closed nuclear facility so that no special measures are required on the plant site due to radioactive materials originating in the dismantled nuclear facility.* So, this means that the decommissioning plans do not include the dismantling of buildings which are released from radiation control. However, because of economical responsibilities, cost estimates for dismantling non-radioactive systems and buildings have been done,

The decommissioning plans have to be updated regularly, at six year intervals, for the duration of the operations subject to a licence.

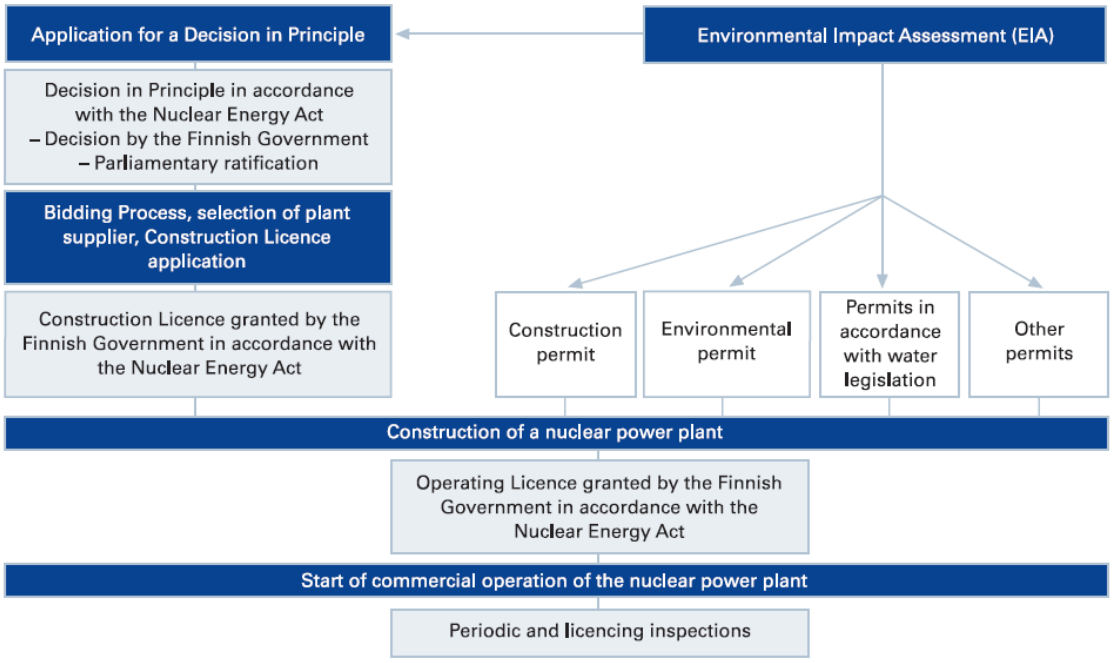

Figure 1. NPP licensing in Finland.

OL3

Decommissioning strategy for OL3 is immediate dismantling, while a 30 years safe storage period is planned for OL1 and OL2. According to the present decommissioning timetable the dismantling of OL1, OL2 and OL3 will be conducted in one campaign.

Decommissioning plan of OL3 describes the planned methods to be used in dismantling work. The goal is to use as much as possible the same equipment and methods which will be used when dismantling OL1 and OL2. Waste amounts have been estimated to be somewhat smaller than from OL1 and OL2, however the activity is higher, because the immediate dismantling strategy.

It is quite obvious that design features beneficial for Radiation Protection have synergy with decommissioning. The design OL3 facilitates easy decontamination of radioactive systems. This enables maintenance and inspection work with minimum radiation doses. The decommissioning plan for OL3 includes a major decontamination prior to dismantling. This supports the immediate dismantling strategy. Also the structural, operational and materials design facilitate decommissioning purposes. E.g. the amount of stellite, which results to activation of cobalt, is optimised. The collective radiation dose from the decommissioning of OL3 has been estimated to be clearly lower than the respective dose from OL1 and OL2.

OL4

The decommissioning strategy and dismantling plans for OL4 will be decided by the time when construction licence will be submitted for authorities. What has been done this far, is the preliminary planning for final disposal of decommissioning waste for OL4. This has been done when preparing extension plans for TVO's present repository for low- and intermediate level waste.

OL4 has been taken into account in the long term safety assessment of the repository. Decommissioning waste activities and volumes have been estimated according the data of OL3. The exception to this is that the measures used for the reactor pressure vessel have been to the biggest RPV of the five alternatives, i.e. ESBWR.

Final disposal of decommissioning waste

TVO's present repository for LILW-waste (VLJ-repository) is planned to be extended for final disposal of decommissioning waste. Presently the repository has two silos which will be adequate for the operational waste from OL1, OL2 and OL3 until 2030's. Interim storages in the plant site will be utilized, as well. The volume of waste from OL4 is not yet known. However, requirements for waste handling systems and set an upper limit for waste accumulation rate will be set already in the bidding process.

The plan for the extension of the VLJ-repository is to build two more silos for operating waste in addition to the two existing silos. For decommissioning purposes the plan is to build four additional silos. The volumes of the silos is of order 10 000 - 15 000 m^3. The planned silo volume will be adequate for the waste volumes with a good margin.

The reactor pressure vessels are planned to be disposed into two separate shafts. These will be drilled in the vicinity of the repository. RPVs of OL1 and OL2 will be put in to one shaft and the RPV of OL3 and OL4 into the other shaft. Engineered barriers for the RPVs will be a concrete tube surrounded by flexible backfill material, most likely bitumen.

A schematic drawing of the extension plan for VLJ-repository is shown in Figure 2.

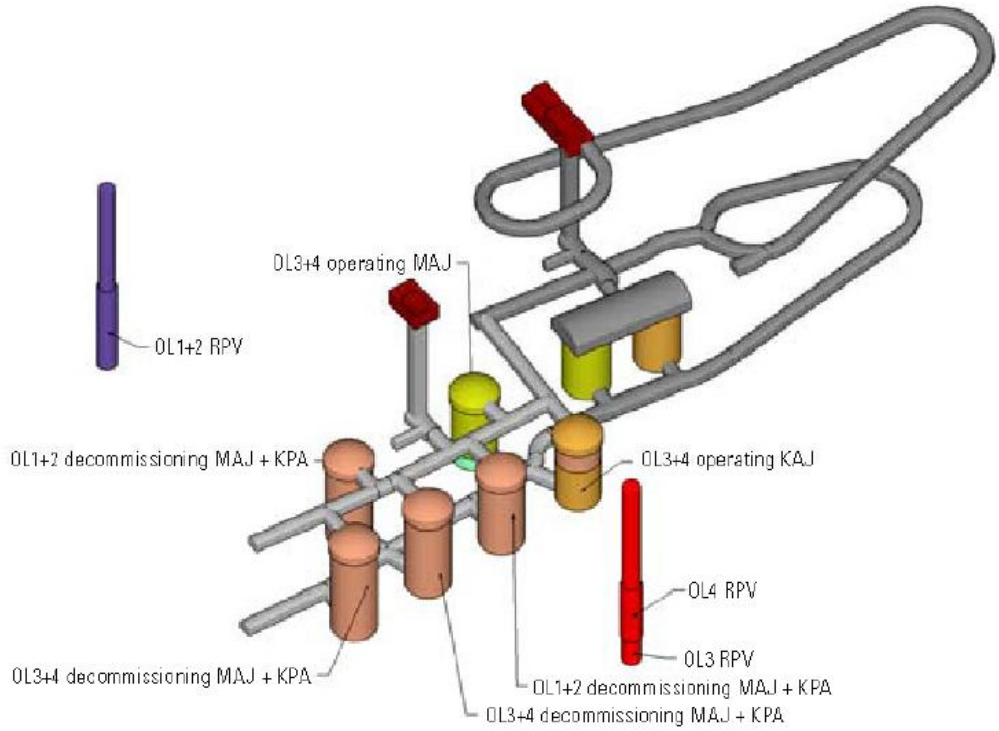

Figure 2. The planned extension of the VLJ-repository.

Funding

The license holder answers for nuclear waste management costs, which are partly formed by decommissioning, also. To guarantee that outstanding nuclear waste management interventions can be carried out in all circumstances, the parties liable for waste management have paid, and shall pay more, if necessary, funds into the State Nuclear Waste Management Fund.

Considering the TVO's power units all a plants are still operate for decades. The funding for decommissioning old plants exists already. Updating of decommissioning plans can have a slight effect the yearly paid liability.

When new plants are considered a transitional phase about 20 years can be applied to collect the liability.

Summary

Nowadays the role of decommissioning is considered early in a new NPP project. In TVO's the long term plans for waste management the requirements set by new plants are taken into account.

The amount of work and resources needed for decommissioning of a modern NPP are estimated to be higher than for older plants. Despite increased work load, the collective radiation dose from the decommissioning project is estimated to be smaller for a new plant.

Decommissioning plans get more detailed in all phases of licensing. After the start of NPP operation the plans are updated in six years intervals and are subject to government approval. For funding purposes, the decommissioning plan is utilised yearly, when the yearly payment to the State Nuclear Waste Management Fund is determined.