SCK•CEN
STUDIECENTRUM VOOR KERNENERGIE
CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE

Safety evaluations for the disposal of high-level and long-lived radioactive waste in clay formations

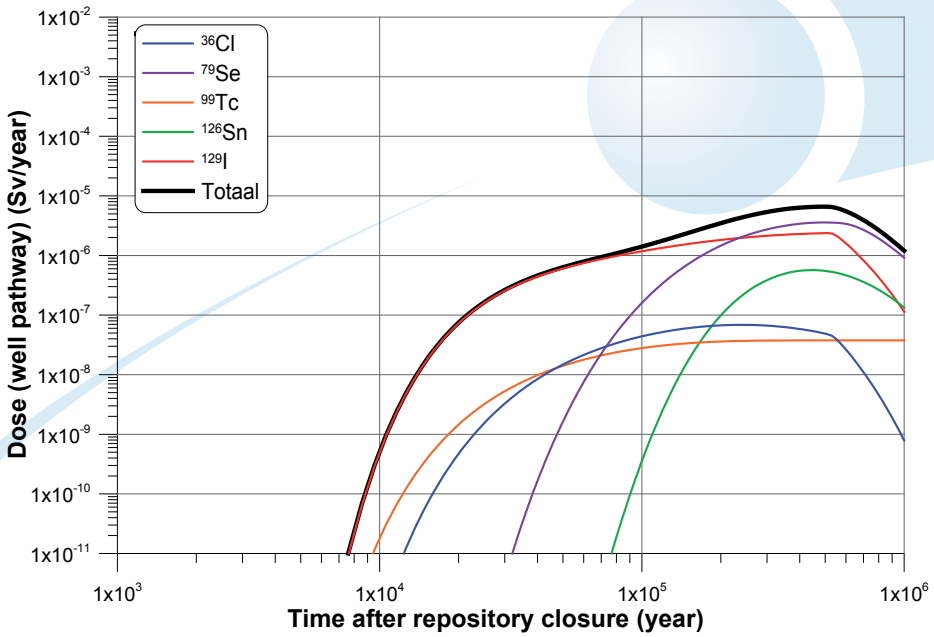
Context

A sound safety evaluation of a repository system for disposal of radioactive waste comprises different steps. The first step consists of the analysis of the evolution of the disposal system under consideration, where the reference scenario considers the expected evolution of the disposal system and its surroundings. In addition, a number of possible but less likely evolution scenarios are identified.

In the second step, a number of numerical simulations of radioactive contaminant transport from the disposal system to the biosphere are performed. The figure shows the evolution of the estimated dose rate for a person who would live nearby the disposal system and would extract drinking water from a well located right above the disposal facility which contains all the spent fuel from the seven Belgian nuclear power plants.

The figure shows that releases of radionuclides in the environment are not expected before 5000 years. Only between 70 000 and 1 million years after repository closure, a dose rate of between 1 and 7 µSv per year is expected in the case of maximum exposure. This is still more than two orders of magnitude lower than the maximum allowable dose for the population.

The figure also shows that only a small number of radionuclides, which dissolve well in water and are not adsorbed by clay minerals, leave the clay layer in significant quantities. The main radionuclides are iodine-129, selenium-79, tin-126, chlorine-36 and technetium-99. Most other radionuclides decay to negligible activities during their stay in the engineered barriers or during their transport through the clay layer.



Evolution of the dose rate for the maximum exposure via a well located above the disposal facility which contains all the spent fuel from the Belgian nuclear power plants.

Objectives

In our study, we evaluate the safety of geological disposal of high-level and long-lived radioactive waste.

Main activities

In order to assess the safety of the disposal of radioactive waste, we develop methods for safety evaluations and numerical models to simulate the evolution of the disposal system and the migration of radionuclides through the various system components.

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