Modelling and Assessment of Radionuclides Differential Transport in Groundwater.

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Groundwater contamination is difficult to sample and monitor requiring great dependence on models to predict the fate and transport as well as the level of contamination in this pathway.

The contaminated groundwater may be considered a potentially significant exposure pathway if the radionuclide concentration in the groundwater exceeds the legal levels, or if the contamination at a particular site could eventually provoke the radionuclide concentrations in groundwater to exceed trigger values. If the radionuclides concentrations in groundwater downgradient from the site, or in leachate at the site, exceed these values, and the groundwater in the vicinity of the site has the potential to be used as a source of drinking water, it is likely that groundwater modelling will be useful, if not necessary; it is also an unavoidable support tool for the eventual decision of site remediation.

An important step in groundwater modelling is identifying the type and approximate quantities of the radionuclides present. This will not only determine the potential offsite impacts, it will also help to identify the magnitude of the risks to potential exposed receptors, the radionuclides mobility and the time period over which the radionuclides may be hazardous. The types of radionuclides will also determine whether radioactive decay and the ingrowth of radioactive daughters are important parameters that will need to be modelled. On the other hand, the ability to reliably predict the rate and direction of the groundwater flow and contamination transport has a critical role in planning and implementing groundwater remediation. This paper presents an overview of the essential components of groundwater water flow and contaminant transport modelling in saturated porous media. It is described the methodology used in groundwater modelling flow, the results of different mathematical interpolation techniques and software tools used to evaluate radionuclides spatial variability and define the underground contamination plume.

A contaminated site from a former uranium mine was taken as a case study. To evaluate the level of contamination in the site and in its vicinity, the radionuclides of the U-chain, in particular for uranium and radium concentration, were monitored in the groundwater of the site. Data from a total of 30 sampling points including holes and wells were used to assess the extension of radium and uranium contamination in groundwater.

The high radionuclides content registered for underground waters suggest that the site has been contaminated by the former mine works and it was concluded that there are two preferential plume contamination directions, whether uranium concentration or radium concentration are present, suggesting that SW-NE direction is preferential to radium spread contamination and that NW-SE direction is preferential to uranium spread contamination.