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#08-125 Modelling the response of an in-situ CdTe detector to radionuclides in groundwater.

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This research examines the potential deployment of a cadmium telluride strontium-90 detector in groundwater boreholes at nuclear decommissioning sites. This is represents a novel approach to monitoring strontium-90 contamination at decommissioning sites such as Sellafield, and has the potential to reduce lifetime monitoring costs while providing information on a significantly reduced timescale. A Geant4 simulation was used to model the deployment of the detector in a contaminated groundwater borehole. It was found that the detector was sensitive to strontium-90, yttrium-90, caesium-137 and potassium-40 decay, some of the significant beta emitters found at Sellafield. However, the device showed no sensitivity to carbon-14 decay, due to the inability of the weak beta emission to penetrate both the groundwater and the detector shielding. The limit of detector for such a sensor when looking at solely strontium-90 decay would be 323 BqL^{-1} after a 1 hour measurement and 66 BqL^{-1} after a 24 hour measurement. Existing techniques are capable of examining strontium-90 decay below the World Health Organisations safe drinking water limit of 10 BqL^{-1}. A GaAs sensor with twice the surface area, but 0.3 % of the thickness was modelled for comparison. Using this sensor, sensitivity was increased, such that the limit of detection for strontium-90 was 91 BqL^{-1} after 1 hour and 18 BqL^{-1} after 24 hours. However, this sensor sacrifices the potential to identify the present radionuclides by their end-point energy.

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