ABSTRACT

The tailings basin associated with Western Mining Corporation's Pilot Uranium Mill at Kalgoorlie, W.A., will leak approximately 5,000 cubic metres of low level radioactive liquid waste containing dissolved $Radium^{226}$ into subsurface soils. The value of soil adsorption as a barrier to the transport of dissolved Radium with the seepage was investigated.

A review of available literature describing adsorption mechanisms, and the behavioural trends shown by various cations in the soil solution, implied that dissolved Radium could be removed from percolating solutions by a number of adsorption mechanisms, and that Radium adsorption in a specific waste disposal scenario, would depend on both the chemical composition of the waste and the mineralogical composition of the soil.

Soil from the tailings basin was found to belong to the textural class of Sandy Clays and comprised around 50% by weight kaolinite with minor montmorillonite. Barium, Calcium and Radium Chloride solutions, and a laboratory prepared tailings liquor supplied by Western Mining Corporation Ltd., were used in a series of adsorption experiments with the sandy clay to determine the Radium removal potential and the operative removal mechanism. The experiments with Barium indicated a maximum of around 11,000 milligrams of Radium could be adsorbed per kilogram of soil by a cation exchange mechanism. Clay minerals were implicated as the active soil constituents.

The transport of dissolved Barium through an experimental soil column was successfully modelled using a solute transport equation which accounted for both kinetic and equilibrium aspects of solute adsorption.

The adsorption experiments using the synthetic tailings liquor implied Radium removal would be significantly depressed in that chemical environment; however, in view of the predicted seepage mechanism, and the large quantity of removal potential available below the tailings basin, this was considered of less importance in the overall scheme.

If the seepage is held against gravity drainage, in the unsaturated zone of the soil profile, Radium migration will be retarded physically as well as by soil adsorption. If vertical seepage continues simultaneous to absorption, it appears the soil could exchange virtually all the dissolved Radium for less hazardous cations already associated with the exchange complex.

The basis of managing the completed disposal facility would be the prevention of recharge events occurring through the covering material and thus prevention of the possibility that adsorbed Radium could be redisplaced from the exchange complex. If this can be achieved the cation exchange complex in the sub-surface soils would be expected to effectively retard Radium migration.