Title:

Environmental Impact of In Situ Oil Shale Processing

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The in situ processing of oil shale for the production of oil from the kerogen involves heating the shale slowly to moderate temperatures of between 300^0 C and 400^0 C. At this temperature, gaseous products that evolve from the oil shale are condensed and recovered. The pathways of creation of oil from kerogen are complicated, and there are possibilities of the formation of condensable aromatic products that potentially could dissolve in the groundwater in overlying/underlying aquifers. The transport of these contaminants is governed by multiphase capillary pressure relationships and the associated multiphase relative permeability functionalities. The entry-pressure and end-point saturations define the extent and concentration of the contamination source.

In this paper, we examine the contamination of aquifers in the oil shale zones and the factors that affect this contamination. A two and three-dimensional, multiphase control-volume simulator is used in all the studies. We look at the spatial distributions of concentrations of different species in water with time. Partitioning of the organic compounds into the water phase is pivotal in establishing the concentration of contaminants in the aquifers. The extent of the source and how it is distributed in the overall hydrogeological setting (boundary conditions) are important considerations as well. Thus, the concentrations of potentially hazardous compounds in the groundwater depend on the complex interaction between the chemistry of the oil generation process, the rock-fluid functionalities (capillary pressures and relative permeabilities) and the hydrogeological settings (aquifer flow rates, boundary conditions, etc.).

In this paper, we show that under certain conditions, condensable hydrocarbons pose a long-term risk to the aquifers associated with the thick oil shale deposits in Colorado and Utah.

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