

**Title:**

**Addressing Water Quality Impacts of Oil Shale Development – Modern Approaches for an Old Problem**

**Abstract:** (Your abstract must use 10pt Arial font and must not be longer than this box)

Following the oil shale development activities of the early 1980s, ensuing scientific advances in the fields of geochemistry and hydrology, combined with practical remediation experience at a diversity of impacted sites, provide a foundation for environmentally responsible water use planning today. Developments in three thematic areas are of significance: (1) Characterization of pre-development hydrology, geochemistry, and ecology with details pertaining to both seasonal and annual variability is now recognized as being of utmost importance to managing resource exploitation in a responsible manner. Instrumentation for continuous monitoring, remote sensing and imagery, and remote sampling are new technologies that should be embraced to establish reliable baseline characteristics. (2) Improvements to microscopic and spectroscopic analytical techniques coupled with image analysis have allowed the disciplines of environmental mineralogy, isotope hydrology, and geomicrobiology to emerge as mature topics. Redox-disequilibria, inorganic-organic interactions, surface-controlled reactions, dynamic interactions among hydrated and volatile phases, colloids, and microbes are essential components in predicting the response of surface- and groundwater to land use changes. (3) Computational science has facilitated the development of numerical models routinely used today to predict sources, fates, and transport mechanisms of dissolved and particulate materials, non aqueous liquids, and gases within the unsaturated zone as well as in groundwater. In support of model refinement and calibration, improvements have been made databases of various physical and chemical flow parameters. Holistic watershed models of interactions among climate, hydrology, geochemistry, and vegetation are the most recent tools relevant to assessing impacts of oil shale development on water quality.

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