

Fate of environmentally sensitive elements during oil shale retorting, a review

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In the 1970's and early 1980's, extensive studies were made to determine the fate of environmentally sensitive elements when oil shale was retorted. The retorting processes that were studied included indirect heating by Fischer Assay and the TOSCO Process and direct heating by the Paraho Process. Attempts were made to determine the fate of major components and constituents of concern. To insure accuracy, the Colorado School of Mines, Pacific Northwest Laboratories, and Lawrence Livermore Laboratories independently performed analyses of the raw and spent shale. Sulfur in the raw oil shale was found to be an important control. Retorting in oxygen free systems retarded the breakdown of the pyrite whereas in an oxygen environment pyrite broke down to ankerite and other oxides. Considerable sulfur was transported to the produced water where complex sulfur species were formed that made the water difficult to treat. Contrary to what was expected, not all of the trace elements were tied up in silicate minerals during retorting.