

Marketable Minerals in Permian Basin Waste Water

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Abstract

Every day, oil and gas operators in the Permian Basin recover, as an unwanted co-produced fluid, tens of millions of barrels of saline waste water. During the early years of production, this waste water was recognized as a nuisance and, eventually, a hazard. Until the present day, the recovery of minerals from this waste water for commercial production has been largely untested. This presentation will outline the technical basis for the exploration for these minerals, and illuminate recent technological developments for economically recovering these minerals.

Previous generations of geologists have recognized that in the Permian Basin the connate water in the oil-bearing rocks is in motion. Carol Hill in 1996 published a comprehensive study on the interdependence between the motion of these fluids with the chemistry of the rocks, the chemistry of the fluids and the dissolution and deposition of minerals. Later work by Art Saller and co-workers illuminated the origin of the fluids through the examination of the water chemistry.

Permian Basin operations have, for many years, unintentionally recovered some of the minerals from this hyper-saline water. Scale in the form of calcium and magnesium sulfates and calcium and magnesium carbonates have been a nuisance in the oil field from the beginning. Additionally, barium in solution is incorporated into this scale as the mineral barite, and is a Naturally Occurring Radioactive Material.

Also known to exist at measurable concentrations in Permian Basin water are boron, cadmium, cobalt, lithium, potassium, rubidium and strontium. Other potentially recoverable metals whose presence in Permian Basin waters is unknown are beryllium, copper, molybdenum, nickel, silver, thorium and uranium.

Lithium mining in the past has been mostly by way of the hard-rock mining of spodumene (which contains lithium) and the evaporative precipitation of LiCl and Li_2CO_3 from brines. Recent advances in membrane technology have successfully recovered lithium from brines without the need for the broad footprint of an evaporative pan. In this way the recovery of lithium from Permian Basin water is possible, and under certain conditions could become a significant secondary revenue stream.

In 1976 the USGS convened a symposium on "Lithium Resources and Requirements by the Year 2000", within which oil field waste water was identified as a probable source of recoverable lithium. The exploration for lithium and other metals will require the sampling of waters over a broad geography in the Permian Basin, and across a broad spectrum of strata, with analysis by way of atomic emission spectrometry.