

LITHIUM IN TEXAS WATER AND OTHER MINERAL ENERGY RESOURCES

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Lithium is categorized as a “critical mineral,” defined as a non-fuel mineral vital to the economic and national security of the United States (US) and essential in the making of batteries. Your cell phone battery and other batteries all rely on lithium to operate.

The Department of Energy (DOE) funds projects across the US to identify lithium resources and rare earth elements (REEs) critical to our economy. These REEs are not necessarily rare, but they are unique in their chemical properties and importance in electronic manufacturing. Some batteries, magnets, and automobile catalytic converters need neodymium, rhodium, cobalt, yttrium, and numerous other oddly named minerals that you do not hear about every day. However, these minerals can be found in Texas! Lithium is found in water but can also be found in Texas coal, along with some of the other REEs. This publication will focus on lithium and its presence in Texas water.



Texas coal fields are found along the Gulf Coast and have been an important energy source until recent efforts to reduce the burning of fossil fuels. Coal has historically been used in power plants to generate electricity by converting it to ash. Critical minerals and REEs have been found in these coals, most often within the sedimentary layers between the seams, and known to result from the deposition of volcanic ash as the coal was being formed. Seams and partings are rich in clay, which is derived from the geologic aging of volcanic ash. Analysis of the coal, associated clays, and especially the fly ash from power plants have discovered a range of lithium concentrations (as well as other REEs).

Texas oil and gas plays generate large volumes of produced water. For example, for every barrel of oil produced, 6 to 8 barrels of very salty water is also produced. The level of salt could be 10 times greater than ocean water. This produced water is rich in lithium, and that wastewater has been disposed of in injection wells across the state. These injection wells are deeper than the

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original oil reservoir, and sometimes cause earthquakes as they inject water into the ground. After analyzing the water produced from 600 wells, a few were found to have economic concentrations, meaning extracting the lithium from the water would result in profit. Lithium is similar to sodium in its chemical characteristics and is often found in and near salt deposits.

Drinking water across Texas has been analyzed and reported, and concentrations of lithium were found across the state. Drinking water concentrations derived from groundwater wells range from 2.8 to 219 parts per billion (ppb) across 3,123 sample locations across Texas. Lithium is not regulated in the US, but the nonregulatory health-based recommended level is 10 ppb. Symptoms of toxicity, including tremors, nausea and diarrhea, vision changes, and confusion, have been reported.

Lithium is used medicinally as a mood moderator to treat mental health conditions. Additionally, several studies in Texas, Japan, and England have found a significant correlation between lithium concentrations and public safety, with low criminality (including suicide) in regions with high lithium and high levels of criminality in regions with low lithium. If you are currently prescribed lithium for health reasons, you may want to analyze your water to reduce the chance of imbibing too much. If you are on a municipal well system, you can

find the concentration in your yearly chemical analysis report. To locate the chemical analysis report, call your water provider or check their website. If you are on a domestic well, you may want to analyze your well water if you exhibit any toxicity symptoms.

The produced water from 600 producing oil and gas wells was analyzed, and most of the water contained less than 40,000 ppb, while five wells in the Deep Edwards and Smackover Play in Northeast Texas reported 100,000 ppb. Ocean water typically contains around 200 ppb. To economically extract lithium from water, the concentration needs to be at least 100 ppb, but the technology is rapidly changing.

Lithium can be mined from arid salt playas, and proposals are underway for locations such as the Great Salt Lake for mining. Currently, most lithium mines are located in South America, with Bolivia, Chile, and Argentina producing nearly half of the world's production. Lithium can also be found in volcanic-ash-derived clays in China and Australia.

The technology used to process lithium is quickly advancing, and costs are declining to the point where recycling power plant ash waste may become an important energy source. Processing the wastewater from oil and gas development could become another profit stream.

Windmill photo by Kristine Uhlman, former Texas A&M AgriLife Extension Program Specialist – Water Resources