



GEOLOGICAL SURVEY

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SMACKOVER FORMATION LITHIUM UPDATE FOR 2021

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Smackover Formation Lithium Update For 2021

Peng Li

For over 100 years, the Smackover Formation in the Gulf Coastal Plain of southern Arkansas has played an important role in the U.S. conventional energy economy. Since the 1950s brines pumped from the Smackover Formation have been used for the extraction of bromine (Arkansas is the world's second largest producer of bromine). That same bromine-rich brine also has commercial lithium concentrations (Collins, 1974, 1976). The previous research reported that lithium concentrations up to 370-423 mg/L occurred in certain H₂S-rich Smackover Formation brines in southern Arkansas (Moldovanyi and Walter, 1992).

The demand for lithium has skyrocketed in recent years as it is a key component in lithium-ion batteries for electric vehicles, energy storage systems, and electronic devices. Standard Lithium Ltd., a lithium development company headquartered in Vancouver, Canada, currently has two projects in southern Arkansas, where it is engaged in testing and proving the commercial viability of lithium extraction from the Smackover Formation brines: one with global specialty chemicals company LANXESS Corporation and another with TETRA Technologies, Inc (Figure 1).

LANXESS Project

In May 2018, Standard Lithium Ltd. signed a memorandum of understanding (MOU) agreement with LANXESS and its U.S. affiliate Great Lakes Chemical Corporation (GLCC) to test and assess the extraction of lithium from over 150,000 acres of brine already processed (“tail-brine”) at three LANXESS bromine extraction facilities in southern Arkansas. These three facilities (South, Central, and West) will produce and transfer lithium chloride solutions via pipeline to the Central location to be processed into lithium carbonate (Figure 1).

A resource report was published by Standard Lithium in November 2018, followed by a preliminary economic assessment (PEA) in August 2019.¹ The average lithium concentration used in the resource calculation is 168 mg/L. The total resource for the LANXESS project was estimated at 3,140,000 tonnes lithium carbonate equivalent (LCE), with a planned production of 20,900 tonnes per year. Although the planned project operation time is 25 years, this resource estimate could extend production beyond this timeline.

Additionally, in November 2018 the Arkansas Oil and Gas Commission (AOGC) approved a joint application from Great Lakes Chemical Corporation and Arkansas Lithium Corporation, a new subsidiary of Standard Lithium Ltd., to operate a pilot plant in El Dorado, Arkansas. During the summer and into the fall of 2019, Standard Lithium Ltd. constructed a LiSTR Direct Lithium Extraction (DLE) demonstration plant in Ontario, Canada, which was broken down into modules and shipped to a LANXESS brine processing facility at their South Plant. Initial installation was

completed in October 2019, and in December 2019 they completed installation of a semi-permanent structure to enclose the plant and ancillary laboratory, as well as an office and control room. Since the beginning of 2020, utility and service connections were completed and the Plant entered the commissioning phase. An announcement in May 2020 expressed the successful completion of the commissioning phase and the start-up of this plant. As part of a continuous process of derisking, two different processes of converting lithium chloride to the final product of lithium carbonate have been evaluated by Standard Lithium. In September 2020, an initial total volume of 20,000 liters of lithium chloride solution were shipped from Arkansas to two locations: Veolia Water Technologies at its facility in Plainfield, Illinois using the original equipment manufacturer (OEM) technology which is widely used within the industry; and Saltworks Technologies in Richmond, British Columbia, Canada using the Standard Lithium's proprietary SiFT crystallization process. In December 2020, high purity (99.92%), battery-quality lithium carbonate was successfully converted at the company's SiFT pilot plant. In March 2021, the company announced that it had completed the conversion of its Arkansas-produced lithium chloride into 99.985% pure lithium carbonate using established OEM carbonation technology. In the summer of 2021, the SiFT plant was relocated from British Columbia to the LANXESS South Plant, installed adjacent to, and connected to the LiSTR DLE Demonstration Plant (Figure 2).

TETRA Project

In December 2017, Standard Lithium Ltd. entered into an Option Agreement with TETRA Technologies Inc. to acquire certain rights related to brine exploration and production, and lithium extraction activities on approximately 27,000 net brine acres of leases located in Columbia and Lafayette Counties (Figure 1). Limited brine samples in the TETRA project (also known as Southwest Arkansas project) area showed lithium concentrations ranging between 347 and 461 mg/L. The maiden PEA of TETRA project was issued in February 2019, which estimated the total inferred lithium resource at 802,000 tonnes LCE. In November 2021, the company issued the second PEA report, which updated the 2019 inferred resource estimate and applied a gross acreage (approximately 36,000 gross mineral acres) with 100% brine ownership that is consistent with the unitization within the Arkansas Brine Statute. The total inferred lithium brine resource was estimated at 1,195,000 tonnes LCE.

Note:

[1]: Standard Lithium's resource reports and PEA reports are available at <https://sedar.com/DisplayCompanyDocuments.do?lang=EN&issuerNo=00012543>.

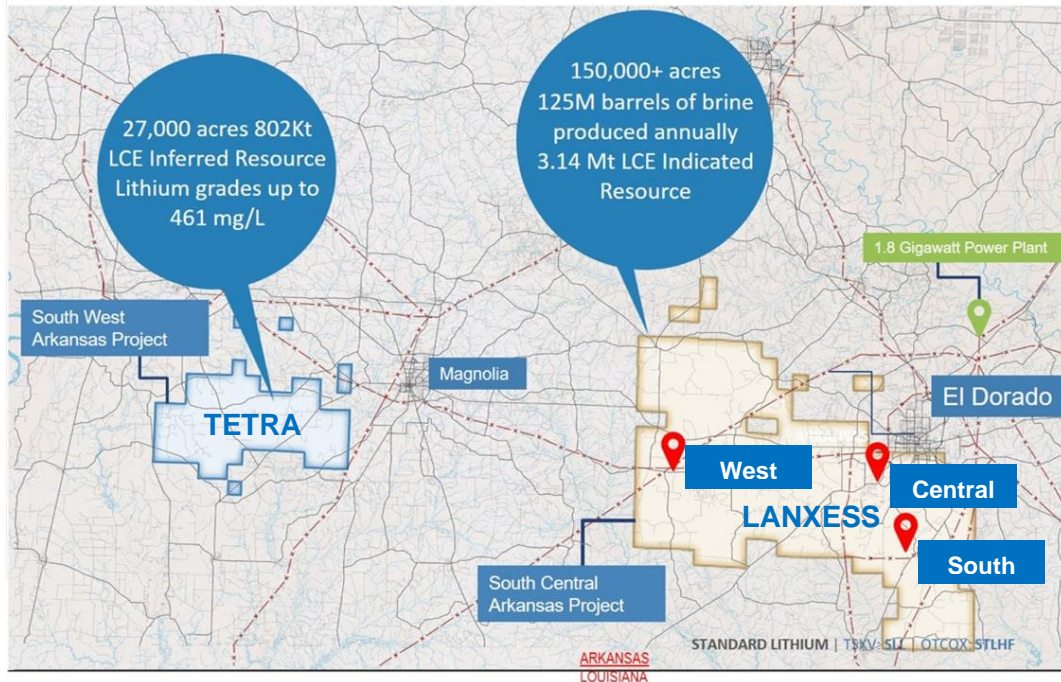


Figure 1. Location of the Standard Lithium projects in southern Arkansas



Figure 2. SiFT pilot plant installed and integrated with the existing DLE plant inside the weatherproof structure in El Dorado, Arkansas. (Photo from the Standard Lithium Ltd. news release dated on September 1, 2021)

References

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Moldovanyi, E.P., and L.M. Walter, 1992, Regional trends in water chemistry, Smackover Formation, southwest Arkansas: geochemical and physical controls: American Association of Petroleum Geologists Bulletin, v. 76, p. 864-894.