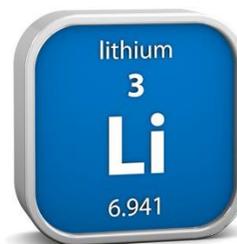


# SWENSON

## Technology Leader in Lithium Crystallization Since the 1950s

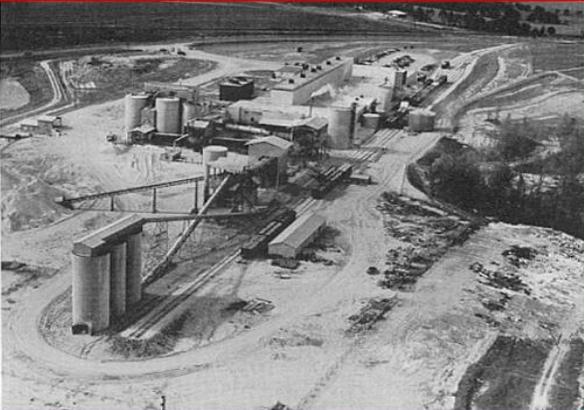


Since 1889, Swenson has been supplying chemical and mining companies with reliable process equipment and assisting in process development to support our global clients.

Since the 1940s, lithium has been an important and strategic metal. Swenson has supported the lithium production industry providing process development followed by the supply of processing equipment. In the US, lithium production began utilizing spodumene ore. The company, Lithium Corporation of America (LCA), began operation of a mine and refinery in North Carolina during this period. The plant processed spodumene ore from both US and Canadian sources.

The lithium processing plant included the calcination of spodumene at high temperatures followed by roasting and  $H_2SO_4$  acid leaching. The PLS was then passed through divalent cation purification steps to remove Ca and Mg. Swenson supported the process development and was chosen to meet LCA's needs in every stage of the evaporative and crystallization process, meeting purity standards for the conversion of the ores into lithium hydroxide monohydrate ( $LiOH \cdot H_2O$ ). Since that initial supply, Swenson continued to support LCA and other leading lithium production companies to expand the lithium industry.

The current needs of the spodumene and other mineral sources are very similar to a project that Swenson supplied the complete purification and crystallization process for in 1953 as described in the diagram below. This was a first-of-a-kind project and the plant operated successfully for many years with follow-on expansions and technology upgrades.

<p><b>Spodumene Plant</b> <b>Bessemer City, NC USA</b></p> <p><b>Swenson Supplied Equipment:</b></p> <ul style="list-style-type: none"><li>✓ <b>PLS Five Effect Evaporator</b></li><li>✓ <b>Glauber's Salt Crystallizer</b></li><li>✓ <b>Anhydrous <math>Na_2SO_4</math> Two Effect Crystallizer</b></li><li>✓ <b>Crude <math>LiOH \cdot H_2O</math> Four Effect Crystallizer</b></li><li>✓ <b>Refined <math>LiOH \cdot H_2O</math> Single Effect Crystallizer</b></li></ul>	
--	--

Swenson has assisted a number of major lithium producers (spodumene and brine sourced) in the development of purification, crystallization, and drying technologies to provide state-of-the-art advantages in product quality in a highly competitive market. Many of the tests have been conducted at Swenson's own Test Center in Harvey, IL. Swenson's designs and supplies are guided by the knowledge and years of experience gained through numerous supplies to the lithium industry.

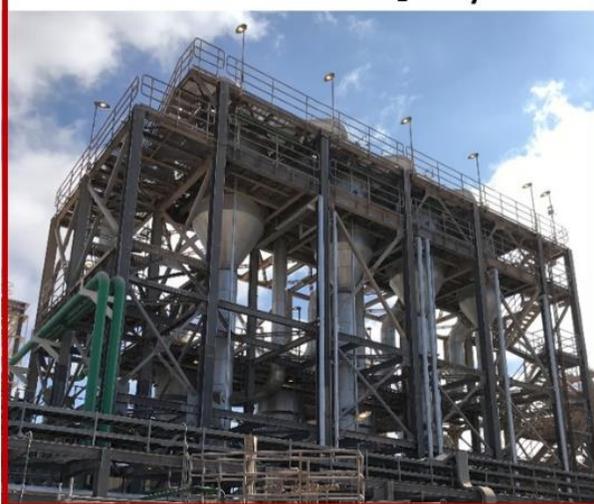
# SWENSON

Chemical markets are cyclic and tend to have periods of growth and step change developments. Swenson has participated in each period of growth and technology advancement. Swenson's support in the lithium industry has covered many decades and the changing needs of our clients.

Evaporators & Crystallizers Experience	1950s	1960s	1970s	1980s	1990s	2000s	2010s	2020s
<b>LiOH·H<sub>2</sub>O</b>	✓		✓		✓	✓	✓	✓
<b>Li<sub>2</sub>CO<sub>3</sub></b>	✓	✓			✓	✓	✓	✓
<b>LiCl</b>	✓	✓	✓	✓			✓	✓
<b>Li<sub>2</sub>SO<sub>4</sub></b>	✓		✓	✓		✓	✓	✓
<b>Na<sub>2</sub>SO<sub>4</sub>·10H<sub>2</sub>O</b>	✓	✓	✓	✓	✓	✓	✓	✓
<b>Na<sub>2</sub>SO<sub>4</sub></b>	✓	✓	✓	✓	✓	✓	✓	✓

Swenson's experience began in the US and Canada with Metalloy Corporation (later known as Lithium Corporation of America, FMC, Livent) and Foote Mineral Company (later known as Cypress Foote Mineral Company, Chemetall Foote Corporation, Rockwood Lithium, Albemarle). Internationally, working with Sociedad Quimica y Minera de Chile S.A (SQM), as the leader in lithium production, to produce high quality LiOH·H<sub>2</sub>O crystals for the battery industry.

**Swenson Four Effect LiOH·H<sub>2</sub>O Crystallizer**



In Chile, Swenson has provided two lines of LiOH·H<sub>2</sub>O for 6,000 and 7,000 tpa in 2003 and 2016, respectively. In addition, Swenson supplied two 8,000 tpa lines in Chile in 2019 and 2022.

A 50,000 tpa Li<sub>2</sub>CO<sub>3</sub> crystallization system is currently under supply for the production of battery grade Li<sub>2</sub>CO<sub>3</sub> using Swenson's draft tube baffle technology (originally patented in the 1950s).

A partnership with Swenson offers clients a resource with extensive knowledge of the spodumene PLS and brine purification processes, backed by multiple successful

installations, and rooted in 70 years of working with major lithium producers.