



CUSTOMER CASE STUDY

Albemarle harnesses the power of AI at scale

Albemarle - www.albemarle.com

Industry - Chemicals and mining

Challenges

- Meeting the rapid growth in lithium demand required more efficient processing
- Expansions in production capacity generated hundreds of thousands of data points to manage
- Manual data-sharing and reporting processes led to information bottlenecks

Solution

- A massive, standardized implementation of the AVEVA™ PI Data Infrastructure offering from the AVEVA™ PI System™ portfolio to manage data, feed advanced software tools, and optimize operations across Albermarle's global enterprise

Results

- More than \$150M in estimated annual improvements from cost savings, cost avoidance, and revenue enhancement
- \$1M in estimated savings a year from improvements in overall equipment effectiveness
- 75% reduction in environmental incidents
- 50 tons of downstream emissions reduced for every ton of lithium produced

In 2019, the sales of electric vehicles (EVs) topped out at 2.5M globally. In 2023, the figure jumped to 15.7M. By 2030, experts expect to see EV sales leap all the way to 46.9M. The rapid rise in EV adoption is promising news for our journey toward a net-zero future. It's also good news for lithium producers like Albemarle—so long as they can keep up with demand. Lithium is a primary ingredient in batteries, and EV batteries require plenty of it. To give you an idea of just how much: right now, the battery in your cellphone contains about a gram of lithium. An EV battery contains 10,000 times that.

Albemarle is one of the world's leading lithium producers. To meet the ballooning demand for lithium, the company is expanding its already sprawling operations. Its manufacturing and refining sites are spread across the world, some just built, others just acquired, and more on their way. But as Albemarle's production capacity grows, its data is growing with it—and rapidly. That's why the lithium leader is harnessing economies of scale with AVEVA PI System to mine value from data across its global enterprise.

From data to insight with Albemarle Intelligence

Around Albemarle, A.I. doesn't just mean artificial intelligence. It also means Albemarle Intelligence. It's what the company brands the AI-powered system at the heart of its global transformation project. "At a very high level," says Jonathan Alexander, Manufacturing AI & Analytics Manager at Albemarle, "we take our data, and we put it through this fancy AI machine, and we create insights, or opportunities."

And at the heart of Albemarle Intelligence, there's AVEVA PI System. It serves as the data infrastructure and analytics engine that powers the many software tools used by operators and engineers across the enterprise. These advanced tools and trusted

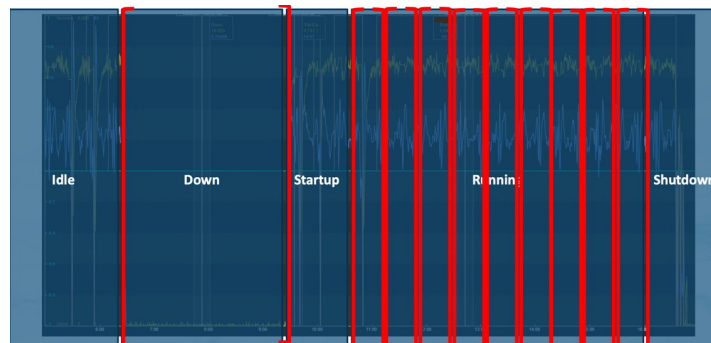
insights empower the team at Albemarle to identify opportunities for optimization much faster than traditional methods allow. That means decision makers across Albemarle can spend less time searching and calculating, and more time actually seizing those opportunities to deliver improvement projects.

"AVEVA™ PI Server functions as our analytical engine that fuels different software tools within the PI System and from external partners, and then we use those different tools—those different insights—across a variety of different user roles all across the organization, all across the world."

Jonathan Alexander

Manufacturing AI & Analytics Manager, Albemarle

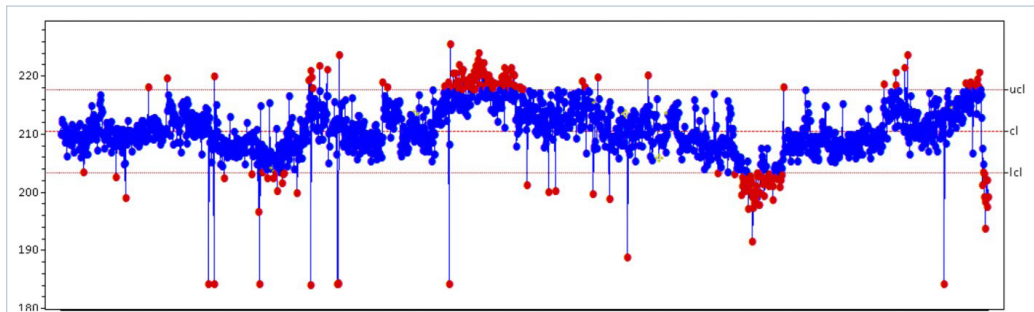
The strategy of Albemarle Intelligence is based on event frames, a bedrock feature of AVEVA PI System. "We like to call ourselves the event frame kings of the AVEVA community," Alexander says. Event frames allow users to sample time-series data and convert it into datasets, the prerequisite of any advanced analytics tool. Take, for example, a continuous manufacturing process. An event frame has a start trigger and an end trigger, which allow users to isolate any particular event—like startup, shutdown, running, idle, and so on—across the phases of a given process. By sampling this event, they can compare it against past events, and even further past events, again and again and many times over, until the user has a sufficiently robust dataset. This dataset helps Albemarle understand how well a process is performing, and how it could be improved, at every state of operation.



The red lines indicate event frame start and end triggers, capturing events across various operational states of a process

Then, with AVEVA™ PI Vision™, the team can visualize these key events over time, filter out the noise, and create valuable statistical process control (SPC) charts. Alexander pulled up one such chart as an example, a three-month SPC analysis of an unspecified process

(pictured below). “When this one was read,” he said, “we found we were having an equipment failure. This one single chart saved us \$500,000 a year. And we have a lot of these.”



Example of a three-month statistical analysis Albemarle performed using the event frames in AVEVA PI System

The power of economies of scale

How Albemarle’s data management system functions isn’t especially groundbreaking in itself. The real story lies in its sheer scale. “None of this is revolutionary,” Alexander says. “But what we’re trying to do is do this bigger than anybody’s ever done it before.”

And that’s not hyperbole. To date, Albemarle has created more than 3,800 reusable asset framework templates for different heat exchangers, reactors, pumps, distillation columns, and other assets, which it visualizes with the help of over a thousand AVEVA PI Vision displays. The team has developed over 9,000 custom formulas and analytics to capture all the different signals from across its operation sites and over 25M event frames. From that staggering quantity of event frames, the company has derived over 500 datasets, over 20,000 statistical analysis charts, and over 500 machine learning models to assist its operators on site. So far, Albemarle has trained over a thousand operators and more than 300 engineers on the new system.

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— Jonathan Alexander

Manufacturing AI and Analytics Manager, Albemarle

Altogether, these newly trained experts have already delivered more than 200 improvement projects. A downtime and environmental safety improvement led to an annual savings of \$350,000. An improvement in capacity and quality led to an annual savings of \$450,000. Another improvement project on quality and rate nets Albemarle \$850,000 in savings a year. The list goes on. In total, the experts at Albemarle estimate the company is saving at least \$150M every year. “And that’s currently the number I’m approved to share,” Alexander says. “As you can imagine, our growth is about in line with the lithium growth.”

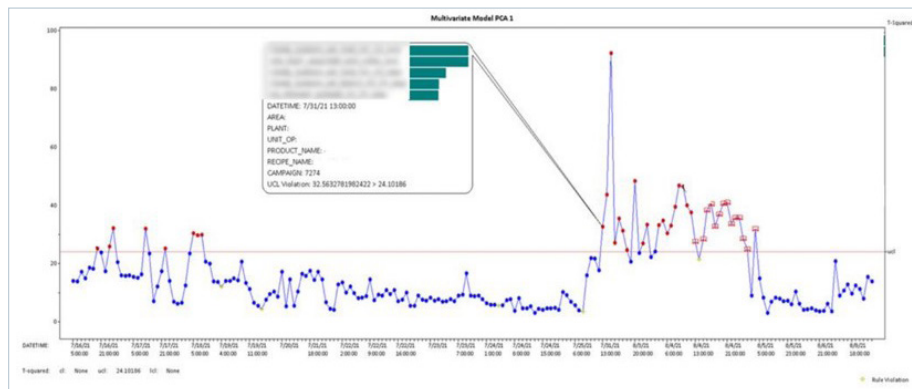
Saving costs, saving the environment

Lithium may be essential to building a greener, energy-secure future, but, in the meantime, the mining and manufacturing processes required to produce lithium entail sizeable environmental footprints of their own. However, after taking the emissions from processing into account, the company still estimates an overall downstream reduction equal to 50 tons of GHG emissions for every ton of lithium produced. It's already a favorable bargain, but Albemarle still goes to great lengths to achieve as small an environmental footprint as possible. There, too, data proves key.

For the past twenty years, one particular unit operation had been plagued by constant issues, resulting in lost time and lost money. One operations engineer even had to cancel her vacation for emergency troubleshooting.

That's when the manufacturing AI and analytics team at Albemarle stepped in and brought all the unit's data into AVEVA PI System. They went to work capturing event frames, building datasets, and ultimately developed a real-time machine learning model, which tracks 300 different variables across the unit operation. From there, the team can apply a multivariate SPC diagnostic tool, which operators on the shop floor can access in real time—no need for engineers to cancel any more vacations.

This new, data-driven ability to rapidly identify process anomalies has led to massive improvements, both operationally and environmentally. Improvements in overall equipment effectiveness equate to about \$1M in savings a year and a 75% reduction in environmental incidents.



Multivariate statistical process control diagnostic tool

A better future for everyone

The success of Albemarle's ambitious global transformation illustrates an essential lesson of our time, so far as industry is concerned: more sustainable operations are more profitable operations and vice versa. One needn't come at the expense of the other.

This lesson is only made all the more impactful when it involves economies of scale. On their own, improvements to equipment effectiveness, small tweaks and process optimizations, might not seem all that revolutionary. But add them up, many times over, across the enterprise and across the world, and the result is a better future—for the business, and for the planet.

References:

Alexander, Jonathan. "Albemarle Economies of Scale with the PI System and AI: the world's top Lithium producer shares its journey."

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- [2. resources.osisoft.com/presentations/albemarle-economies-of-scale-with-the-pi-system-and-ai--the-world-s-top-lithium-producer-shares-its-journey](https://resources.osisoft.com/presentations/albemarle-economies-of-scale-with-the-pi-system-and-ai--the-world-s-top-lithium-producer-shares-its-journey)

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