



WHITE PAPER

Uncovering new value: How to use existing data to optimize chemicals plant operations

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Executive summary:

Chemicals companies are under pressure. Between market demands and operational challenges and the drive toward a sustainable future, plant personnel have to focus on many things at once. To overcome challenges and reach sustainability goals, they must maximize production, reduce unplanned downtime, and optimize processes and assets.

Many chemicals operations have already adopted AVEVA™ PI System™ as their data management platform, enabling condition monitoring of both assets and processes with real-time analytics. Many plants have used AVEVA PI System to achieve both asset reliability and operations success; for others, however, it is time to take the next step.

Chemicals companies can extend the value of their data management platform to deploy more intelligent ways to optimize performance, predict outcomes, increase safety, and conduct maintenance at exactly the right time. From rigorous process simulations and AI-based advanced analytics to hybrid models, the possibilities are endless. By layering in advanced tools on top of AVEVA PI System, chemicals businesses can find new ways to optimize plant operations to ensure a safe, sustainable process that meets production goals.

Introduction

Running a chemicals plant is complicated. Companies face pressures from multiple directions, including increased competition and changes in demand, safety concerns, and sustainability initiatives—and each of those pressures is felt on the plant floor. Overcoming these challenges is just as complex, requiring plants to optimize assets and processes, maximize production, reduce unplanned downtime, and ensure safe, predictable operations that meet overarching business goals.

In response, numerous chemicals companies have turned to operations data to give teams the insights they need to optimize plant outcomes and mitigate challenges to meet ever-changing demand. Many organizations have deployed AVEVA PI System as the data management platform of choice to collect, manage, and analyze the growing amount of historical and real-time operations data. AVEVA PI System serves as a foundation from which to deepen the digital transformation journey. With a single source of truth for operations data, chemicals plants can layer in advanced tools that will enable production optimization, predictive maintenance, and operational digital twins. With newer, faster, and deeper insights, teams can debottleneck operations and reduce maintenance and operational costs, all while continuously improving efficiency, reliability, safety, and sustainability.

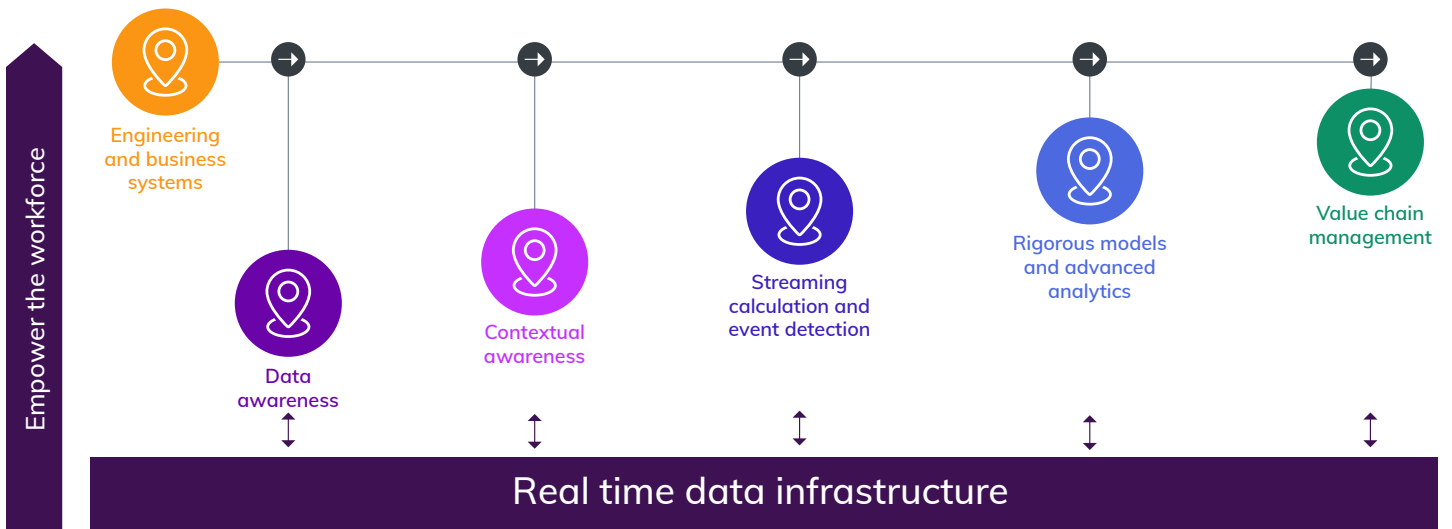
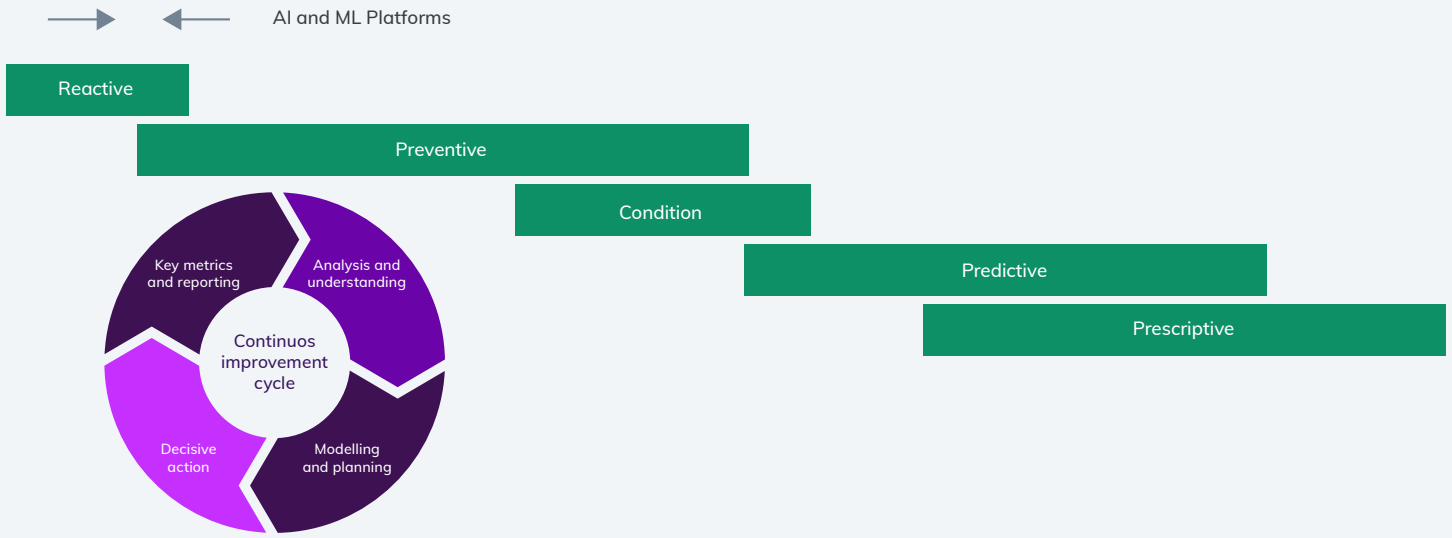
Growing chemical demand: Research and Markets estimates that the global chemicals industry is projected to grow at a compound annual growth rate of 7.8% by 2027.¹ Post-pandemic recovery has been negatively affected by a surge in commodity prices and ongoing supply chain disruptions due to geopolitical tensions. This puts additional pressure on chemicals plants to operate more efficiently than ever.

Building the foundation to optimize operations and maintenance

AVEVA PI System takes an agnostic approach to data management, allowing chemicals companies to bring together disparate sources of data into one centralized location and serve as a single source of truth for operations data. By enabling users to add critical context to operations data, AVEVA PI System is more than a historical or real-time data analysis tool—it's the springboard for advanced applications.

Every chemicals plant is on its own unique data-driven journey. While some operations are using AVEVA PI System as a historian, others have moved further along the utilization curve and are using streaming calculations or advanced analytics. Regardless of where a plant is in its AVEVA PI System journey, users can still find new ways to optimize plant operations to meet production, safety, and sustainability goals.





AVEVA PI System journey: As chemicals plans extract deeper insights, they move further along the curve to enable predictive and prescriptive insights.

For example, the combination of historical data and AVEVA PI System real-time data facilitates the transition from reactive to preventive and condition-based maintenance (CBM). Contextualized data ultimately supports condition-based maintenance (CBM), enabling visualization, event detection and notifications, and streaming analytics to trigger events and measure performance. From there, companies can layer in additional applications to enable predictive and prescriptive maintenance as well as digital twins for operations troubleshooting.

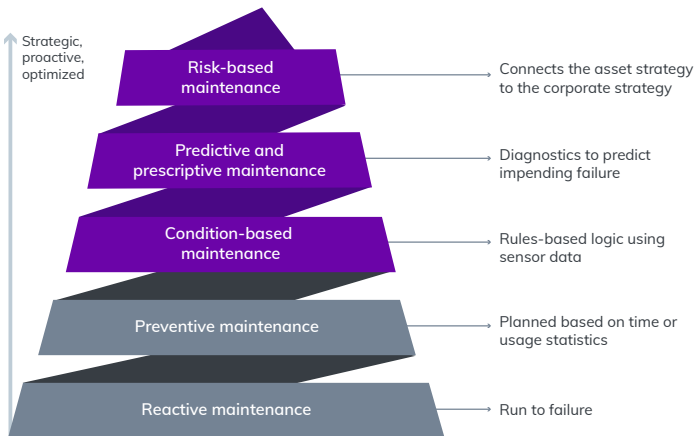
Moving from reactive to predictive maintenance

Chemicals companies around the world are taking AVEVA PI System capabilities even further by using artificial intelligence (AI) and machine learning (ML) models on top of operations data infrastructure. These models are fed by real-time, contextualized data from AVEVA PI System and results are returned to AVEVA PI System, enabling users to perform predictive analytics and gain faster, more valuable insights to optimize processes and assets, minimize unplanned failure, and create predictable outcomes. By leveraging predictive analytics, chemical companies can capitalize on the wealth of data and maximize their data management infrastructure return on investment.

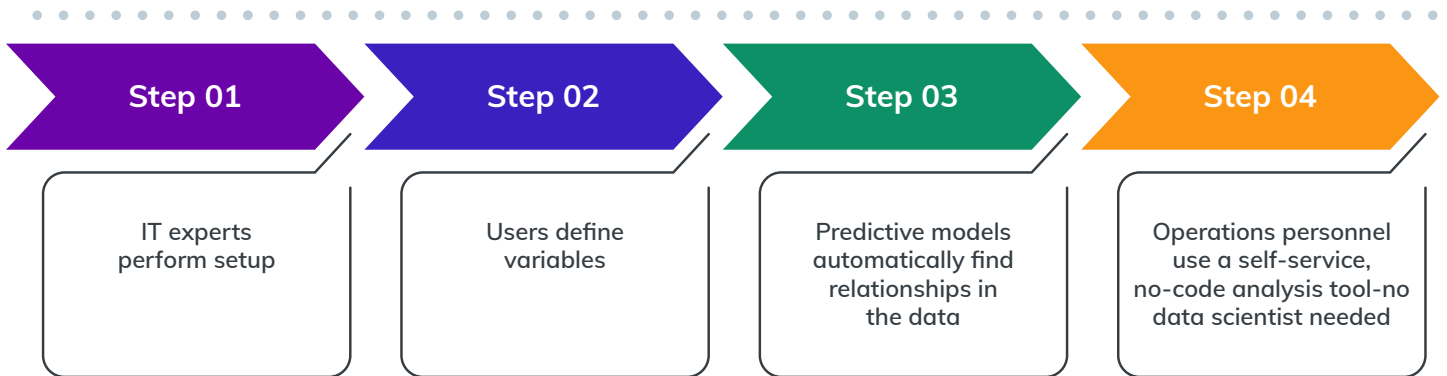
The maintenance journey

Moving to predictive or prescriptive maintenance strategies doesn't happen overnight. Users will need to lay the right data foundations and establish change management strategies to ensure optimal outcomes.

It's a journey



When companies use predictive analytics in conjunction with AVEVA PI System, they embark on a continuous improvement cycle, moving further along on their maintenance journeys.



Quick deployment combined with a simple user interface ensures rapid ROI, while user-defined variables and standard operating procedures enable knowledge capture should experienced personnel leave.

Predictive models use deep learning tools to forecast an asset's remaining useful life, giving teams critical information and prescriptive insights to analyze cost versus risk and devise plans that maximize efficiency and profitability. Users can define leading indicators based on sensor and other operations data and use this information to detect even subtle changes in asset performance. Once they identify an anomaly, teams can use advanced tools to predict performance degradation and component failures and then work together to prioritize maintenance needs based on urgency, schedules, available teams and resources, spare part availability, and more.

In addition to preventing asset failure, predictive models can provide further benefits. AI-based guidance allows companies to minimize energy usage, compare asset performance, and diagnose anomalies, helping chemicals plants stay in regulatory compliance, meet contractual obligations, and deliver better asset and process outcomes. With future insights into asset performance, companies can take action to minimize inefficiencies that affect financials, gauge future consequences, assess risk, avoid disruption, and even increase customer satisfaction.

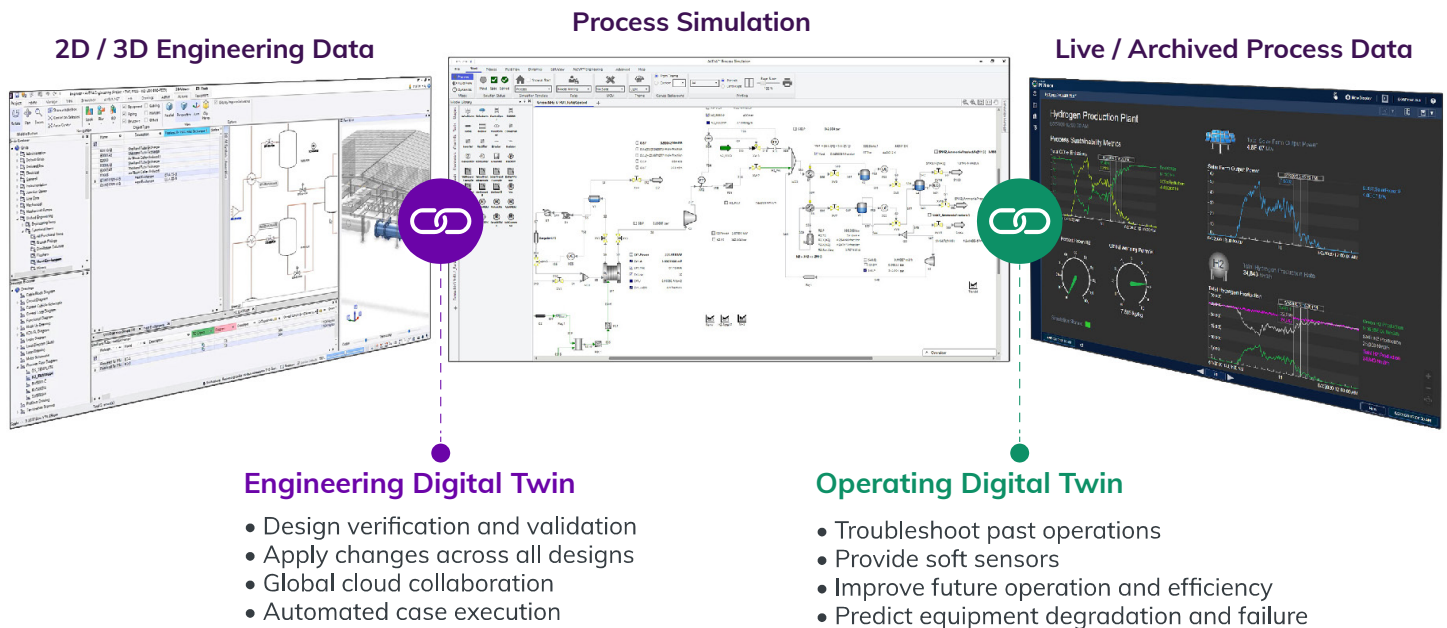
Layering process simulation enables critical insights

When chemicals companies use AVEVA PI System to underpin digital twins, they can enable new ways to use process simulation. In the past, process simulation was typically used during the engineering phase and other tools were used to evaluate plant behavior. However, now teams can run the same process simulation from the design phase to improve operations.

By combining it with real-time data from AVEVA PI System, process simulation enables immediate troubleshooting and continuous improvement. Using rigorous first-principles models, process simulation becomes the single-truth model, which extends the digital twin from engineering to operations. Enabling one digital twin across the entire plant life cycle gives teams the insights they need to improve efficiency, reliability, safety, and sustainability.

While process simulation and predictive analytics are well-known approaches, these tools have continually improved over the past few years. First-principles simulation combined with AI-driven predictive analytics models have enabled powerful operations digital twins based on hybrid models.

This approach gives engineers insight into unmeasurable process variables and optimal operating conditions, allowing models to proactively predict reliability issues for rotating and stationary assets across the enterprise. As a result, the predictive models are even more accurate and can anticipate potential equipment failures sooner than ever before.



Air Liquide: AI algorithms improve maintenance strategies



Air Liquide's Large Industries Division must provide a constant stream of oxygen, hydrogen, and more to its customers, which means any asset downtime requires meticulous planning.

The company must negotiate any downtime with customers and even arrange alternate product supplies. Then, Air Liquide must have subject matter experts and maintenance teams in place and available at exactly the right time, along with all necessary parts and personnel.

For nearly 20 years, Air Liquide has used AVEVA PI System to manage and analyze its massive amounts of operations data. However, to efficiently and meticulously plan its maintenance to meet its stringent customer requirements, Air Liquide needed to predict asset degradation and potential failures. In response, the company deployed AVEVA™ Predictive Analytics to better serve its customers and improve workplace reliability and safety.

AVEVA Predictive Analytics now enables teams to use artificial intelligence algorithms on top of the company's historical AVEVA PI System data. Using over 3500 predictive models monitoring assets across 140 locations, teams can easily identify degradation and isolate contributing factors before asset failure.

For example, teams received a notification that the water temperature decreased in a heat exchanger, giving them enough notice to plan a teardown when it was convenient. Upon inspection, they discovered several compromised welds, including one that was leaking, which would ultimately lead to a catastrophic failure.

Thanks to the combination of AVEVA PI System and AVEVA Predictive Analytics, Air Liquide has not only improved its maintenance, the company has created new partnerships between its customers, operations, analysts, and SMEs.

SCG Chemicals: Predictive analytics increase plant reliability



As one of Asia's largest chemical companies, SCG Chemicals must continue to optimize asset performance and reduce the risk of failure to maintain its status as a key industry player.

To address risk and reach its goal of zero plant shutdowns, SCG deployed its Digital Reliability Platform (DRP) to monitor critical assets and predict failure. Using a mix of on-premises and cloud-based applications, the DRP integrates online and offline equipment data to visualize plant performance, enhance workforce efficiency, and apply artificial intelligence for predictive maintenance and resolution.

At the heart of the DRP is AVEVA Predictive Analytics. By continuously monitoring real-time equipment behavior using a variety of data sources, the solution alerts operators when performance deviates from historical thresholds and projects every asset's remaining useful life. This enables teams to make strategic decisions that prioritize asset repairs and maintenance while mitigating the risk of failure.

In just five short months, AVEVA Predictive Analytics enabled SCG Chemicals to increase plant reliability from 98% to 100% and decrease overall maintenance costs.

Covestro: Process simulation accelerates operations troubleshooting



Covestro used simulation models to predict asset behavior, but existing models were not efficient and results weren't always reliable. The company needed to take a more efficient approach, which included improving how they tracked "non-measurable phenomena."

To streamline and simplify its simulation models, Covestro deployed AVEVA™ Process Simulation on top of its existing AVEVA PI System. By taking a templated approach, the combination of the two solutions simplified setup and real-time data interpretation, which ultimately enabled more accurate diagnostics and more agile decision-making. Now, teams can easily scale up to use process simulation in additional plants, which includes driving comparative value and economies of scale across the business.

Overall, Covestro anticipates that the combination of AVEVA Process Simulation and AVEVA PI System will reduce the amount of time teams spend on simulation model maintenance by 20%.

Conclusion: Less analysis, more action

AVEVA PI System provides the critical data management foundation that enables predictive analytics and process simulation using digital twins. By layering advanced AVEVA solutions on top of the existing AVEVA PI System infrastructure, chemicals companies can take advantage of real-time and historical operations data to gain access to deeper, faster, and more valuable insights to support business objectives and the overall business strategy. This allows chemicals companies to find the balance between risk-based and reliability-centered maintenance, improve overall performance, and avoid potential equipment failure. With real-time advanced insights at their fingertips, chemicals plant teams can make better, faster decisions that continually improve plant performance, safety, and sustainability – while benefitting the bottom line.

AVEVA Predictive Analytics and the PI System allow chemical companies to move towards operational excellence while delivering a 10 to 20% reduction in OPEX.

About the author



Stephen Reynolds is the Industry Principal for Chemicals. He has been with AVEVA for over three years, first as a Center of Excellence Engineer, then as a Customer Success Advisor.

Prior to AVEVA, he worked nearly 20 years in the Chemicals Industry, serving in a variety of roles from Unit Engineer to Operations Manager in both Operations and Continuous Improvement. Stephen holds a degree in Chemical Engineering from Texas A&M University.

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