

Chemical Manufacturer Improves Critical Asset Availability with Enterprise AI



A global chemical company is a leading producer of olefins, plastics, and other industrial chemicals, operating in over 150 countries. The company had a strategic priority to improve utilization of its production lines and process units, focusing first on its fleet of steam cracking furnaces. Steam cracking furnaces are critical in the process of converting lower-value petrochemical feedstocks into high-value olefins, as unplanned downtime of furnaces translates directly to lost production.

Prior to engaging with C3 AI, the company relied on standard monitoring tools to manage the health of furnaces. The existing solutions provided univariate, threshold-based alarms, and limited visibility or early warning of critical reliability issues to operators. As a result, they faced high variability in maintenance needs and sub-optimal decoking schedules for furnaces.

The chemical company decided to engage C3 AI and deploy the C3 AI Reliability on Microsoft Azure application to improve

furnace reliability, visibility into furnace maintenance intervals, and furnace run lengths.

The company chose C3 AI Reliability because the application is equipment agnostic – meaning it could scale to other asset classes in the future – and the company could start quickly with its most high-value use case. The company also chose to partner with C3 AI because of the scalability of the C3 AI Platform, which allows the company to adopt a single AI platform for multiple AI use cases.

With C3 AI Reliability on Microsoft Azure, the company has improved availability of furnaces by 1.4% and extended average run length by 10+ days. With anticipated scale out of the application to the company's fleet of 200 furnaces, the company estimates that the economic value generated by the application is at least \$45 million per year due to reduced downtime and increased asset utilization.

Project Objectives

- Enable predictive monitoring capabilities for critical equipment in olefin manufacturing, starting with steam cracking furnaces
- Increase asset utilization for steam cracking furnaces through improved furnace reliability
- Increase production by extending furnace run lengths with improved visibility into furnace coking rates
- Expose AI insights and unified analytics to end users through an intuitive user experience

Results

\$45 million+

annual economic benefit at scale-out to 200 steam cracking furnaces

10+ days

increase in average furnace run length, from 40 to 50 days

1.4%+

increase in furnace utilization

Challenges

Improving steam cracking furnace reliability is a strategic priority for the chemical company's hydrocarbon business. Steam cracking furnaces are critical in converting lower-value feedstocks into high-value olefins, which are both sold commercially and used internally in downstream production operations. Unplanned furnace failures translate directly to production losses and lower revenue for the company.

The chemicals company had previously implemented software to help maintain continuous and safe operations, but these tools provided primarily univariate alerts and did not support real time machine learning or advanced monitoring. Consequently, operators could not predict equipment degradations or failures in advance, and were unable to proactively take action to reduce downtime.

In addition, operators could not accurately forecast furnace cleaning needs. A key driver of furnace maintenance is coking progression, which determines when furnaces should be shut down for cleaning (i.e., decoking). As furnaces operate, a layer of coke accumulates on the process coil. When a critical limit is reached, furnaces are taken out of production for hours to days to be de-coked. However, time between decoke events can be highly variable, ranging from 20 to 60 days. With limited forecasting capabilities, maintenance teams were faced with reactive maintenance and shorter than expected runs.

The company decided to partner with C3 AI to deploy an application on Microsoft Azure that can:

- Predict furnace failures in 5 days in advance to reduce unplanned events
- Predict and forecast furnace coil coking rates and critical limits to extend run lengths from 40 to 50 days
- Scale across a global fleet of steam cracking furnaces to improve global operations

Approach

In a 12 week pilot project, C3 AI partnered with the chemicals company to configure C3 AI Reliability on Microsoft Azure to predict failures and to forecast coking progression for two steam cracking furnaces.

The team configured the application by first ingesting, cleansing, and unifying two years of historical data from 7 systems, including sensor data, maintenance data, asset hierarchy, asset utilization, engineering drawings, condition-based monitoring, and quality data. Using the unified data image, the C3 AI team developed and tested over 20 machine learning (ML) models to predict furnace failures using advanced anomaly detection. The team also developed 4 models to forecast coking progressions.

The C3 AI team met with subject matter experts on a weekly basis to validate results, draw on customer expertise, and build trust across the organization. C3 AI trained over 20 reliability engineers and operators to use the application, investigate AI evidence packages, and take corrective action. The team also trained

About the Company

- Operates in 150+ countries
- \$50+ billion annual revenue in 2023
- 30,000+ employees

Project Highlights

- 2+ years of data from 7 enterprise systems unified, including 750 sensors and 180 million rows of timeseries data
- 24 ML models trained and tested to predict steam cracking furnace failure
- 10 C3 AI Reliability application user interface screens configured
- 4 customer data scientists onboarded and trained to deploy models to scale C3 AI Reliability to additional furnaces and new assets
- 20+ end user engineers and operators onboarded through live and online training workshops



4 customer data scientists and data engineers to use the C3 AI Platform on Microsoft Azure to configure, train, validate, and deploy ML models to scale predictive maintenance across their organization.

Finally, the team configured the right, fully workflow-enabled C3 AI Reliability 10-page user interface to visualize AI-based furnace health and coking forecasts, and to help end users take action. The application provides a complete workflow for an asset engineer to review and investigate AI-based alerts, create cases to document investigation, and submit work orders for maintenance needs. Together, C3 AI and Microsoft Azure are enabling customers to achieve operational excellence, drive AI adoption at scale, and respond to complex challenges with confidence.

Solution Architecture

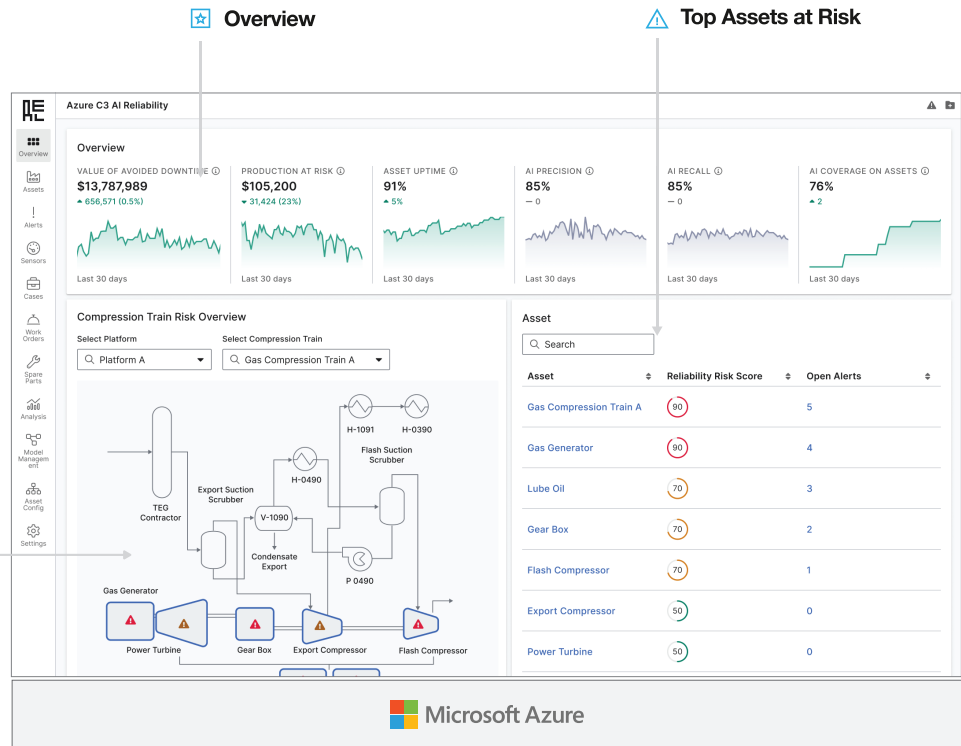
Azure C3 AI Reliability

Enterprise Data

- Sensors
- Maintenance Data
- Failure Event History
- Asset Hierarchy
- Asset Configuration
- Weather Data



Process Flow Diagram



Benefits

With C3 AI and the C3 AI Reliability application, the chemicals company is now able to:

Generate

\$45+ million in economic benefit at scale-out to global fleet of 200 steam cracking furnaces

Improve

utilization of steam cracking furnaces by 1.5%

Forecast

coking rate with 5-day look-ahead to efficiently plan maintenance activities

Extend

average furnace runs by 10+ days, from 40 to 50+ days

Monitor

asset health and coking progressions for steam cracking furnaces in near real-time with advanced machine learning

Expand

predictive maintenance across global operations with a flexible, fast-to-deploy AI application

Expand

AI use cases to new business challenges with a flexible, scalable AI platform, such as improving supply chain visibility

Proven Results in 6-Month Pilot

Visit C3.ai/get-started