Fero Labs

Industrial Use Case Playbook

Proactive Herbicide Quality Stabilization

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Introduction

Welcome to the **Industrial Use Case Playbook**, crafted by Fero Labs for the forward-thinking professionals dedicated to enhancing factory production optimization.

Whether you're a Data Scientist, Process or Production Engineer, Quality or Plant Manager, this playbook is tailored to equip you with the strategies, insights, and tools necessary to drive transformative change within your organization.

In today's rapidly evolving industrial landscape, maximizing production efficiency and minimizing operational costs are imperative for maintaining competitiveness and sustainability.

Within each of our industrial playbooks, we present a curated collection of use cases designed to address the specific challenges faced by modern manufacturing facilities. Each use case is meticulously crafted to deliver tangible outcomes, ranging from increased productivity and quality to reduced waste and energy consumption to help achieve sustainability goals.

Featured within these pages is a use case which spotlights **Proactive Herbicide Quality Stabilization for chemical manufacturers**. This case exemplifies how to tackle complex production optimization challenges head-on, leveraging data-driven approaches to drive measurable improvements in operational efficiency and cost-effectiveness.

As you embark on this journey for operational excellence, we encourage you to approach each Fero Labs use case scenario with curiosity, a willingness to embrace innovation and change.

By harnessing the power of your production data, domain knowledge, and collaborative problem-solving, we believe that you can unlock the full potential of your factory's production capabilities.

Together, let's redefine what's possible in industrial manufacturing and pave the way for a future of unprecedented productivity and sustainability.

Welcome aboard,

Fero Labs

Industry Overview

In the realm of chemical manufacturing, ensuring consistent product quality is paramount for maintaining customer satisfaction, meeting regulatory standards, and preserving brand reputation. Chemical manufacturers operate in a dynamic and competitive environment, producing a diverse range of products essential for various industries, including agriculture, pharmaceuticals, and consumer goods.

Herbicides play a crucial role in modern agriculture by controlling weeds and maximizing crop yields. With the increasing global demand for herbicides to support food production and agricultural sustainability, chemical manufacturers face growing pressure to deliver high-quality products consistently.

However, **ensuring the stability and quality of herbicides throughout their lifecycle** poses significant challenges for chemical manufacturers due to factors such as **raw material variability, formulation complexity, and environmental factors**.

One critical aspect of optimizing herbicide production lies in **Proactive Herbicide Quality Stabilization** strategies. This approach involves implementing proactive measures to stabilize herbicide quality throughout the manufacturing process, from raw material sourcing to formulation and packaging.

By leveraging advanced process monitoring, quality control techniques, and predictive analytics, chemical manufacturers can identify potential sources of variability and implement corrective actions to maintain product quality within specified tolerances.

Proactive Herbicide Quality Stabilization not only enhances product quality and consistency but also contributes to **operational efficiency and cost-effectiveness**. By minimizing quality deviations and production disruptions, manufacturers can reduce waste, improve resource utilization, and enhance overall process efficiency.

Furthermore, as **sustainability** becomes increasingly important to consumers and regulators, Proactive Herbicide Quality Stabilization aligns with broader industry trends towards eco-friendly practices, waste reduction, and resource conservation. At Fero Labs, we refer to this as Profitable Sustainability.

Industry Challenges

In Industry 4.0, the promise of digital transformation often gets stuck in **"pilot purgatory,"** with **70% of initiatives failing to progress beyond testing phases**. McKinsey's research highlights that the choice of use case significantly impacts this phenomenon.

Selecting use cases that lack strategic alignment, clear value propositions, or encounter technical barriers contributes to pilot initiatives' failure.

Pilot purgatory not only wastes resources but also risks eroding confidence in digital transformation efforts. To navigate this challenge, organizations must strategically select use cases closely aligned with their objectives, offering clear pathways to value creation and scalability.

In each **Fero Labs Use Case Playbook**, we explore industrial use cases designed to address modern manufacturing challenges. Leveraging advanced analytics, AI, and machine learning, these use cases aim to drive tangible improvements in operational performance, cost-effectiveness, and sustainability.

By focusing on strategic and transformative use cases, organizations can break free from pilot purgatory and unlock new opportunities for growth and innovation.

Use Case Description

Background

The large-scale chemical production of broad-spectrum herbicides, such as glufosinate, involves a two-step reaction process comprising amination and hydrolysis, followed by distillation and crystallization. The yield and selectivity of glufosinate produced can depend on various factors. These include the molar ratios of raw materials entering the amination reactor, the composition of intermediates fed into the hydrolysis reactor, and the operating conditions such as temperature and flow rates of each process unit. Successfully navigating these factors is essential to ensure high production quality and throughput in this complex chemical process.

Problem

The final glufosinate salt produced is regularly tested in the lab to ensure it meets industry standards. This involves operators manually collecting samples from the last stage of production and sending them to the lab for analysis. The frequency of sampling can vary, occurring every few hours or even daily, and the timing may extend based on the specific laboratory analysis conducted. This infrequent sampling of final product can result in **considerable operational delays** (e.g., during startup or unsteady-state conditions), during which operators do not know if glufosinate is still being produced within specification.

The complex interplay between reaction chemistry and process dynamics often presents a significant challenge for **plant operators**.

Problem Summary

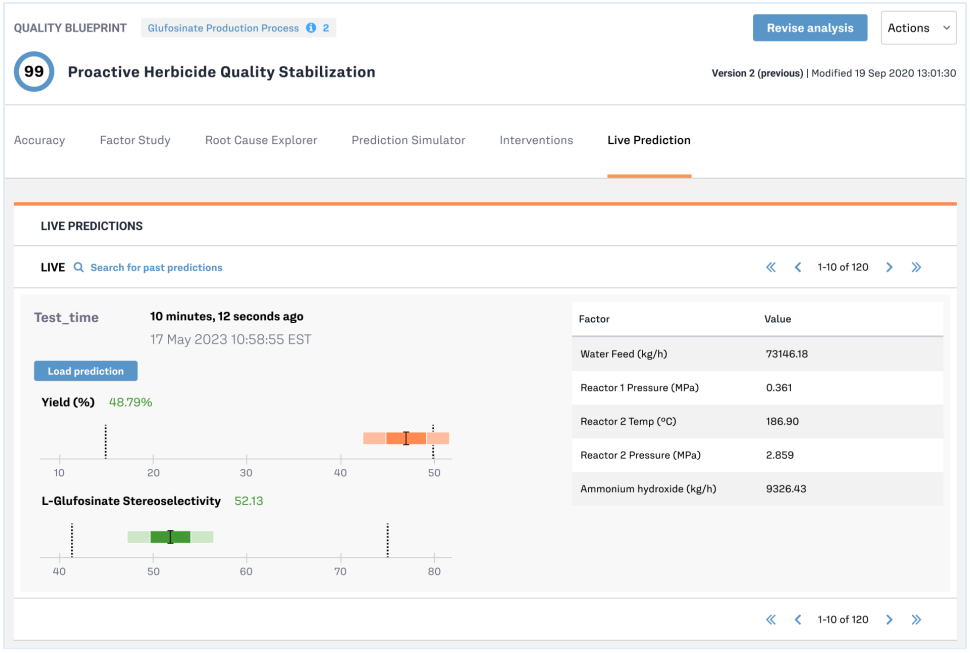
Adapt to upstream process condition variation and proactively prevent adverse effects on glufosinate quality.

The current solution is to course-correct production when the measured final product quality is out of spec. This can result in waste of raw material and decrease in production throughput due to longer inspection times during plant shutdowns, and high environmental and energy costs caused by the frequent starting and shutdown of the production process.

Fero Labs Solution

A virtual soft-sensor can be configured to predict and monitor the reaction selectivity, stereoselectivity, and yield of glufosinate in between the time periods at which samples of glufosinate are being sent and characterized in the lab. This soft-sensor equips plant operators with

real-time insights into the production process, aiding them in determining if the produced glufosinate meets industry specifications. Furthermore, it is instrumental in detecting persistent quality issues, especially when lab results show that the product fails to meet the quality standards. This is critical in guiding plant operators to make informed decisions on making operational changes or initiating an unplanned shutdown, thus minimizing production losses.



Process & Business Outcomes

Real-time monitoring of production quality

Plant operators can gain real-time insight into production quality without having to wait for lab analysis results. They will also have a direct root-cause insight into how operational changes such as changes in raw material flow rates or temperatures can affect production quality.

In-process optimization based on product quality predictions

Soft sensors can enable plant operators to make adjustments to operational conditions based on product quality predictions. This can increase production throughput by **up to 15%.** In a market heavily limited by production capacity, this improvement could also translate into a top-line benefit of **up to 15%**.

Informed decision-making to mitigate unplanned shutdowns

Plant operators can be more confident when deciding to initiate an unplanned shutdown or make an operational change when process abnormalities occur. Similarly, they can be more confident of when they achieve steady-state conditions and production quality within spec during plant startups.

With full adoption of Fero Labs software, plant operators can expect to experience up to **36%** decrease in unplanned production shutdowns and startups.

Reduced lab measurement frequency

A virtual soft sensor can reduce the frequency of lab measurements needed and provide estimates for them at consistent time intervals. This can relieve any laboratory driven process bottlenecks and reduce the total annual lab measurements by as much as **20%**, while providing additional visibility into production.

Fero Labs Adoption Timeline

Plant teams can collaborate to set up and deploy Fero Labs. Below is a timeline highlighting typical steps. With Fero's easy-to-use, no-code interface, this can be achieved in a matter of weeks, not months or years.

Time	Process & Quality Engineers	Data Scientists / IT	Operators	Management
Week 1	Pull data	Pull data		
Week 1	Upload to Fero			
Week 1	Configure Fero	Configure Fero		
Week 2	Corroborate results	Receive example report showing accuracy		
Week 2	Set up Fero Prediction	Set up Fero Prediction		Receive example report showing savings
Week 3	Live data connection	Live data connection		
Week 3	Live Prediction screen		Live Prediction screen	
Going forward	Monitor deployment	Monitor deployment	Follow Fero Optimization recommendations	Receive regular reports showing savings
Going forward	Run "what-if" scenario simulations, spot check production, run root cause analyses		Follow Fero Optimization recommendations	Receive regular reports showing savings

Use Case Data Requirements

The Fero Labs Platform has convenient integrations into common process information management systems, such as Aveva PI System, AspenTech, Wonderware, and SQL databases, as well as laboratory information management systems, such as SAP, Oracle, and other ERP systems. Initial data exploration can be done either through direct integration into these services, or data file uploads in Excel and CSV data formats.

The data requirements for this use case typically involve the following sources:

Lab Analysis Data

- Source: typically LIMS or ERP (e.g., SAP)
- Content: glufosinate yield, L-glufosinate to D-glufosinate ratio, % crystallinity, etc.
- Index: Indexed by time

Premixer Process Data

- Source: typically PIMS (e.g., PI system, Aspen)
- Content: Ammonium bicarbonate, water, etc.
- Index: Indexed by time

Amination Reactor Process Data

- Source: typically PIMS (e.g., PI system, Aspen)
- Content: 3-(Hydroxymethylphosphinyl)propionic acid, aqueous ammonia cyanide, ammonium bicarbonate solution, etc.
- Index: Indexed by time

Hydrolysis Reactor Process Data

- Source: typically PIMS (e.g., PI system, Aspen)
- Content: aminated solution mixed with ammonia and water, etc.
- Index: Indexed by time

Distillation Process Data

- Source: typically PIMS (e.g., PI system, Aspen)
- Content: hydrolysis solution, unreacted ammonia and water, etc.
- Index: Indexed by time

Centrifuge Dryer Process Data

- Source: typically PIMS (e.g., PI system, Aspen)
- Content: distillate bottoms, methanol (drying agent), etc.
- Index: Indexed by time

Activating This Use Case

Consider our **Industrial Use Case Playbooks** as inspiration and tactical ideas for your team to align on to maximize the efficiencies of your plant. Each Playbook has a matching **Use Case Blueprint** which provides detailed steps to activate each use case within the Fero Labs platform.

If you're curious to see these in action please book a use case demo with our team!

Together, let us continue to push the boundaries of what's possible, driving towards a future where industrial manufacturing is not just efficient and sustainable but truly transformative in its impact on society and the world at large.

Thank you for joining us on this journey, and we look forward to continuing to partner with you in your pursuit of excellence.

Sincerely,

Fero Labs

About Fero Labs

Fero Labs helps factories work better together by bridging the gap between the disconnected goldmine of production data and industrial knowledge inside every plant.

The Fero Labs Profitable Sustainability Platform collects data and knowledge, and augments it with powerful Fero ML so factories can make more confident changes that drive profit and sustainability.

Harnessing Fero Labs, a factory creates an augmented workflow which allows for better use of raw and recycled materials, production time, and energy utilization. Teams can work 90× faster, using Fero's AI powered simulated predictions or live optimizations. They can run root cause analyses in minutes, and make continuous process improvements that drive Profitable Sustainability.

Fero Lab's white-box explainable ML makes decisions clearer by showing the context and confidence levels behind every prediction and recommendation. This expands a plant's production knowledge and drives better production results for manufacturers, all while minimizing emissions. Together we'll build a sustainable tomorrow.