

Success Story

Stabilization of Process and Improvement of Operation through Process Data Analysis

Mitsubishi Gas Chemical Company

Location: Kurashiki City, Okayama, Japan
Order date: July 2015
Completion: December 2015
Industry: Chemical (Fine & Specialty Chemical)

 **MITSUBISHI GAS CHEMICAL COMPANY, INC.**

Executive Summary

Mitsubishi Gas Chemical Company (MGC) produces a variety of specialty chemicals from natural gas and petrochemical feedstocks. The company is the first company in Japan to produce methanol and ammonia from natural gas. The company owns and operates oil and natural gas fields in Japan. Based on MGC's group vision of "Creating the value to share with society," MGC provides unique products and services based on its proprietary technologies to industrial customers in Asia, North America, Europe, and other markets.

MGC's Mizushima Plant produces highly original aromatic derivatives from mixed-xylene that have been obtained through the petroleum refining process. These are used widely in products such as plastic containers and perfumes.



Improvement activity of safety or operation has proceeded at its Mizushima Plant. At one of them, MGC selects Yokogawa process data analysis solution that has helped to reduce operator workload and stabilize processes.

The Challenges

In a continuous process that is monitored and controlled by a Yokogawa CENTUM VP distributed control system (DCS), aromatic derivatives are produced at the Mizushima Plant. With the aim of maintaining high product quality and production efficiency, operators carefully monitor this process at pre-specified points. Whenever there are fluctuations in this process, operators of the CENTUM VP DCS intervene to make adjustments. For certain reasons that were not fully understood at first, these fluctuations tend to occur more frequently at night against at daytime. To identify the reasons for these fluctuations, MGC turned to Yokogawa for a process data analysis solution.

Collaborative Analysis with Customer

In July 2015, MGC started working with Yokogawa in a collaborative analysis project using Yokogawa's Process Data Analytics software at the Mizushima plant. Tsukasa Taketa, a section staff leader, had the following to say about this:

"Our plant has been using Yokogawa solutions to improve operations by, for example, automating non-steady operations. Of the various products and solutions that Yokogawa has introduced to us, their process data analysis solution caught my attention. It looked very interesting and I thought it might prove more useful in improving the productivity. I decided to give it a try."



Process Data Analytics screen

Analysis to find process fluctuation factors

Yokogawa analyst Takeo Ueda began analyzing the entire production process to identify when these fluctuations were occurring and find a way to prevent them. To analyze the process data for thousands of tags that have been stored in the Exaquantum plant information management system, one must first have a good understanding of every aspect of the production process, including the raw materials, the control method, and the final products. Moreover, it is necessary to understand how operators act not only when a process is in a steady state, but also when the process enters a non-steady state. While learning about the production facilities, the configuration of the control system, and the P&ID control method from Mr. Taketa, Mr. Ueda stepped forward his analysis of the plant data.

During the analysis phase, Messrs. Taketa and Ueda paid particular attention to the control of the raw material flow rate. They were vaguely aware that a 1% difference in the flowrate was caused by day and nighttime variations in ambient temperature and atmospheric pressure, and that this was causing major fluctuations in the production process. Wondering how this could be, Mr. Ueda tried to avoid any preconceptions that might lead him to ignore or discount certain factors, and analyzed the data using different techniques.

Looking back on this analysis, Mr. Ueda commented: “This analysis at the Mizushima Plant was the toughest that I’d ever done, with me having to try and imagine what conditions caused the variations in the data for thousands of tags. By carefully looking at and sharing this data with Mr. Taketa and the members of his production section, I was able to make progress in this analysis. Any time I had a question for Mr. Taketa he was ready with the correct answer, and I was really impressed with his knowledge of the plant and the production process.”

He went on to say: “Yokogawa’s Process Data Analytics software makes use of the Mahalanobis Taguchi System (MTS), but that’s not all: by examining data from the perspective of the 4M (Material, Machine, huMan, Method) perspective, we were able to select the most appropriate method for analyzing the customer’s plant data, and preprocess and convert the data so as not to miss smaller features. Furthermore, we gave careful consideration to how best to explain the results of our analysis to the customer. We have found that, if the customer is not satisfied with the results of process data analysis, it is difficult to move on to the next stage for problem solving.”

They achieved progress with their collaborative analysis, while closely sharing information on progress and tactics. In August, next month, the team was able to identify multiple factors that caused the process fluctuations. These were due to variations in the flow of raw material, as the team expected. The data proved that a 1% fluctuation in the flow rate significantly impacted the process.

Consideration and execution of countermeasures

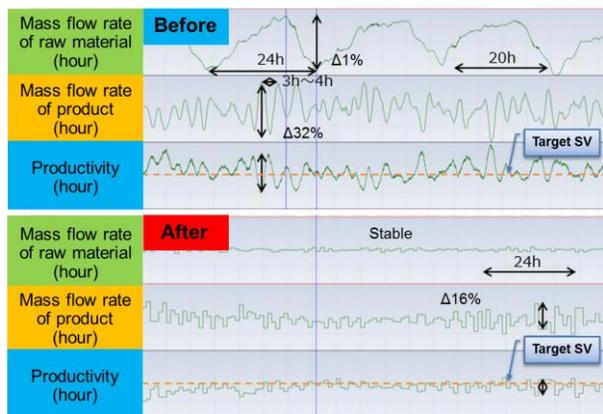
Process data analysis is meaningless if you stop at just identifying the root causes of a problem. To suppress the fluctuations that were occurring at the plant, the staff of the Mizushima Plant, who are professionals in manufacturing, and Yokogawa, who is also professional in instrumentation and control, began considering practical countermeasures.

As a result of these efforts, a control scheme for stabilizing the process was devised, and the control loops of CENTUM VP were modified and improved.

Results

Thanks to the stabilization of the process with the new control scheme, the number of alarms and manual interventions were dramatically reduced. The number of alarm occurrences was reduced by about 20% and manual operations involving both the manipulated variable (MV) and the set variable (SV) were reduced by about 30%. With the process stabilized, the productivity improved as well. According to the operators, “CENTUM became quiet.”

At the Mizushima Plant, as one tool for making improvements, Yokogawa’s Process Data Analytics software is being utilized on a daily basis to achieve super-stable plant operation. And operator abilities continue to be strengthened.



Result of the collaborative analysis (material, quality, cost)

Customer Satisfaction

Masanori Ishikura, general manager of Manufacturing Department 1 and Power Department:

"Safety is the top priority at our plant. We are also concerned about productivity. Improving operator awareness and ability has a big impact on safety and productivity. Process data analysis is also useful in terms of education and human resource development.

However, analysis is not an end in itself. Rather than focusing on analyzing problems after they occur, why not try to have operators who can spot abnormal conditions before a problem occurs? Furthermore, I want our young operators to understand what is happening with physical phenomena and chemical reactions. Our veteran employees have gained this knowledge on the job, but I would like our younger operators to also learn by engaging in analysis. Analysis is good for both improving processes and education."

Susumu Inagaki, section manager of Manufacturing Section 2 Manufacturing Department 1:

"Analysis has begun to help us stabilize operations. Our operators have been actively using analyzing tools like this Process Data Analytics software, and this is particularly the case with our younger operators who will bear the next generation in the future. They seem to understand the processes on a middle expert level and are able to spot potential issues and take preemptive actions before something goes wrong. They keep trying to make things better and, as a result, have gained new skills and improved the stability of our processes.

Staff in other departments at the Mizushima Plant have also been making various improvements. Yokogawa's Exapilot is widely used to automate tasks that are not performed frequently, and our section takes pride in having been the frontrunner with utilizing Exapilot. I am thankful for all the attractive solutions that Yokogawa provides to us."

Toshio Izutsu, deputy section manager of Manufacturing Section 2 Manufacturing Department 1:

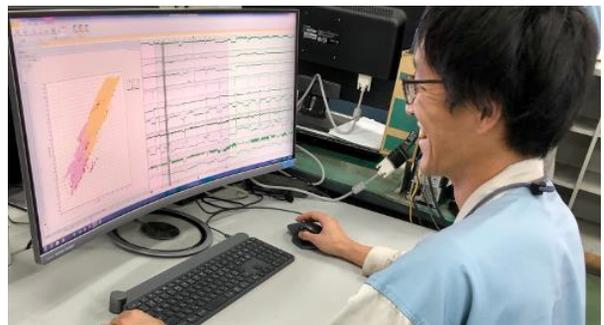
"Thanks to making improvements to our operations with analyzing tool, our staffs here are more curious now about what is going on in our plant and have a greater interest in spotting potential problems, and I think this is a good thing.

Analysis is useful in understanding the sequence of steps in a process and what happens over time with that process. Operators are often mechanically aware of process conditions from their experience. But they can come upon new discoveries if they adopt a more analytical approach. Concerning the matter of the productivity, as such analysis can help personnel to rethink assumptions and take a wider perspective, we will continue to perform this analysis."

Motoki Tsuji, Manufacturing Section 2 Manufacturing Department 1:

"I am currently in charge of the analysis team. When I first joined MGC and was assigned to this section, my more experienced colleagues were working to automate infrequent operations by Exapilot. I had an interest in taking part in their "kaizen" activities and quickly volunteered when Mr. Taketa told me about this project.

Recently, operators have been using data from the Process Data Analytics software to prepare operation reports and other documents, and this practice has been spreading to members other than analysis team. It is very rewarding to know that we have been able to improve the process through our own efforts."



Takeshi Norikane, Plant Maintenance Section Maintenance Department:

"Before moving to the maintenance section, I and Mr. Taketa were among the first members of the analysis team. Our original purpose for doing process data analysis was to make it easier at the start of each workday to check what the situation was with operations on the previous day. At that time I was the only person using the Process Data Analytics software, but now it is entering wider use.

My work with this software has given me a broader perspective. It's good that I can use it to perform difficult calculations, and this has allowed me to handle a wider variety of tasks."

Department name and job title are as of interview.



Recent photograph of the project team

Back row (from left) : Mr. Murakami (*Process Technology Section Research & Development Department*),
Mr. Horiuchi (*Deputy section manager of Manufacturing Section 2 Manufacturing Department 1*),
Mr. Norikane (*Plant Maintenance Section Maintenance Department*)
Front row (from left) : Mr. Narimatsu (*Yokogawa*), Mr. Tsuji and Mr. Taketa (*Manufacturing Section 2 Manufacturing Department 1*), Mr. Fujii (*Yashima Export & Import Co., Ltd.*)

Tsukasa Taketa, Manufacturing Section 2 Manufacturing Department 1:

“The project was a great success. The process was stabilized and the operators found it easier to smile. One excellent outcome is that this project gave people who had never worked together an opportunity to get to know each other. Spreading out like the roots of a large tree, I believe these relationships will make innovation continuously in various ways. It’s my duty to create a lively work environment, and I take pleasure when our people go home to their families and come back the next day invigorated and ready to work.

I want Yokogawa to communicate more closely with us and incorporate our operators’ ideas in their solutions. Forward-looking improvement activities are ongoing at our plant, and I am looking forward to Yokogawa providing solutions that meet our needs. Please surprise me with solutions (said with a smile!)”

Takeo Ueda, data analysis engineer of Yokogawa:

“Mitsubishi Gas Chemical was the first company to use our Process Data Analytics software. I taught Mr. Taketa and Mr. Norikane how to use the software, and now many of the other operators at the Mizushima Plant now use it routinely to make the analyses needed to make improvements. I’m very pleased with this.

In some of my previous projects, root causes have been identified without actually being able to solve the problems, but I am happy to report that Mitsubishi Gas Chemical was able this time to implement the necessary countermeasures. I admire the dynamic efforts that they are making to improve the safety and efficiency of their operations. I am grateful to Mr. Taketa and everyone else at Mitsubishi Gas Chemicals for taking the time to engage in frequent discussions with us on how best to achieve shared goals. A big factor behind the success of this project was the cooperation with MGC, our business partner, Yashima Export & Import and Yokogawa. We were able to work together to achieve a goal.

I look forward to having further opportunities to provide solutions that delight our customers all over the world, and to helping them improve their site operations and the competitiveness of their products.”

For more Information and Contact

[Process Data Analytics](#)

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