

Production Technology, Environmental Safety, and Quality Assurance

Review by the Director in Charge

We make the most of DX technology to push operations at our plants to higher levels while reducing workloads on production floors

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Production and Quality Control at Higher Levels with Full Use of AI and DX Technology

For the MGC Group, a chemical manufacturer, production is the engine of value creation, and safety assurance is our main responsibility to society. Quality that measures up to customer expectations is essential for the sustainable development of our business. We understand that production with fully assured safety and quality is the foundation that secures completion of our Mission, "creating value to share with society."

My main responsibility is to lead our entire organization, regardless of borders between business sectors and Group companies, to establish processes for continuously improving environmental safety and quality assurance and further refine our culture that values safety and quality. Another is to brush up our production technologies and apply them across the Group. Technological expertise to use advanced production equipment safely and effectively influences the competitiveness of a chemical manufacturer, so we make special effort to hone those technologies.

We are working to realize the SMART-FACTORY concept, mobilizing AI and DX technologies, and new systems are under development in three areas of plant management: data, operations, and assets. In managing

plant data, we collect, analyze and process numeric information from each piece of equipment and apply the results to operations and control. In managing plant operations, we collect and manage information related to manual operations of equipment so we can standardize human judgement. In managing plant assets, we store information related to equipment control in a database to encourage and support advanced, comprehensive equipment management. We have introduced an AI-assisted system for predictive analytics and an image recognition system to substantially raise the quality of information management on production floors.

We are currently working to develop a next-generation system to assist operations in our plant infrastructure, combining the world model, in which AI can learn the operational processes of experienced workers through an inductive approach, and the large language model, in which AI can absorb operational expertise via large volumes of explicit knowledge. With this, we hope to further improve our plant operations and realize a kind of automation that reduces workloads on production floors.

Enhancing Responsive Care and Quality Assurance under Two Group Councils

In recent years, we have particularly focused our efforts on furnishing Groupwide access to the expertise on responsive care and quality assurance that we have accumulated through related initiatives. For that purpose, we established the MGC Group Environment and Safety Council in 2003 and the MGC Group Quality Management Council in 2020. Under these councils, the Environment Safety & Quality Assurance Division monitors and reviews the responsive care initiatives and quality management execution plans of Group companies to establish these initiatives as important parts of our corporate culture. Shortly after the councils started their work, some differences in awareness and levels of initiatives among Group companies were spotted, but they have gradually improved across the board. Quality assurance in particular has reached an adequate level of control because Group companies share a sound awareness of issues and a

strong desire to improve.

For efficient production, environmental safety, and quality assurance to operate in unison, and without compromise, it will be important going forward that each Group employee maintains a deep understanding of their job and works together, aiming high. For that purpose, I would like to establish a corporate culture that is "nosy" in a good sense, in which employees are interested in work outside their respective divisions and inspire one another. We cannot realize our Group Mission if useful information and knowledge on safety, quality, and productivity lies solely in the minds of individuals. That is why I work to spread solid production management principles across the organization, applying our AI and DX tools, and to lead the SMART-FACTORY to success with the combined forces of the Group.

Promotion of the SMART-FACTORY

Japan is facing the accelerating decline of its working population, and the issue has become urgent for the chemical industry as well. MGC aims to balance efficient production methods that can be operated even by small numbers of employees with ensuring safety—which is fundamental to production activities—and environmental protection. To achieve these two contradicting missions, we strive constantly to codify the high-level technical capabilities and skills of employees engaged in production activities and pass them on to the next generation, and to introduce and continually improve the latest technologies for our facilities (hardware) and systems (software).

In recent years, we have been focusing on initiatives for a SMART-FACTORY, which will simultaneously realize increased productivity, stabilization of plant operations, and assurance of safety by introducing and leveraging predictive analytics systems and digital tools such as mobile devices, as well as soft sensors that utilize the Company's internal resources. We are developing next-generation plant operation support systems powered by AI that inductively learns and compiles the operation methods and expertise of seasoned operators. In the future, we aim to achieve automated plant operation.

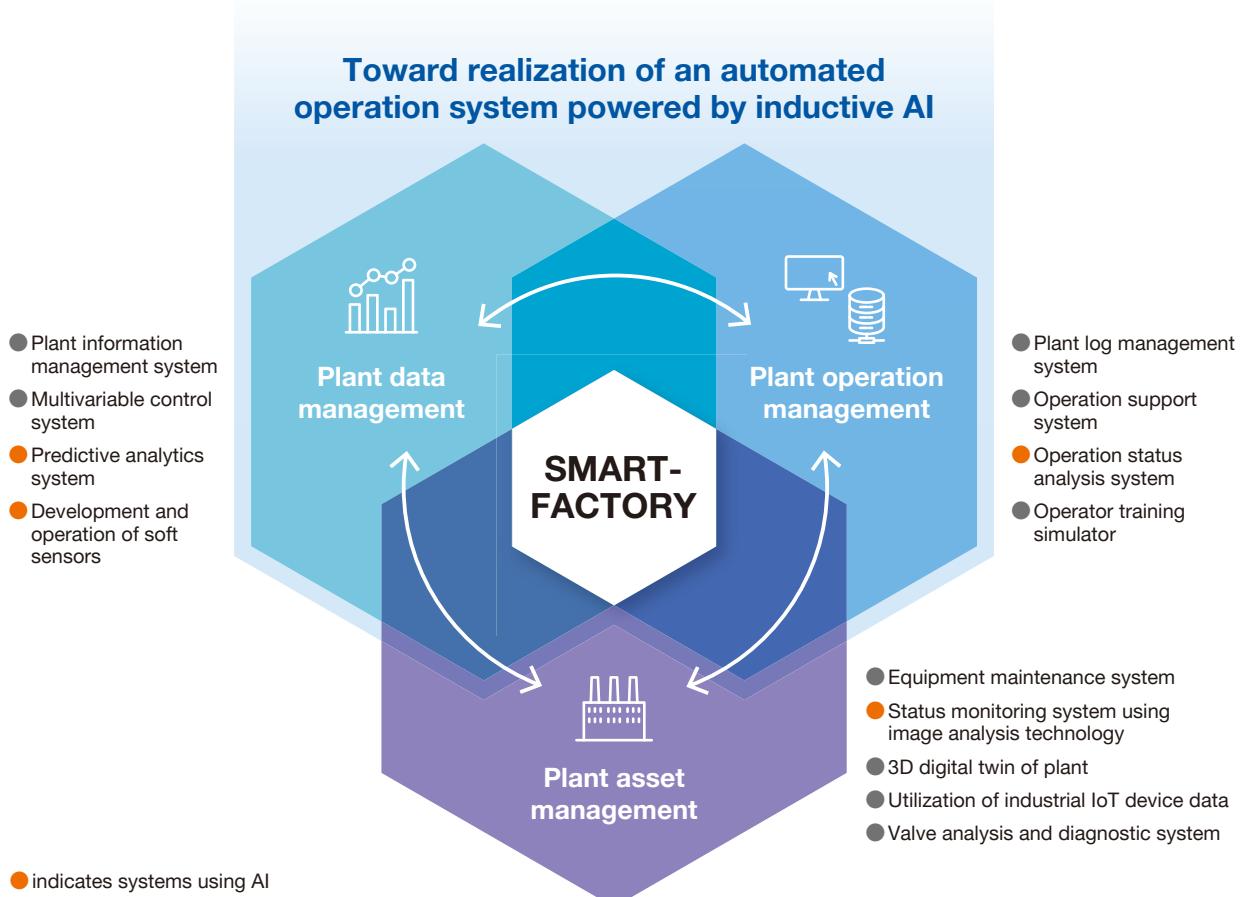
Fiscal 2024 has been a year for establishing a common companywide infrastructure in the form of systems that

securely obtain and aggregate data related to plant operation status and equipment management. After analyzing data acquired in each production process, we use it to propose efficient operation management and optimal equipment maintenance strategies. Furthermore, going forward, we will link data with different systems to use in important decision-making in the areas of plant data, plant operation, and plant asset management. We will also increase the level of our activity as we move into a solutions proposal phase.

At the Niigata Plant, we have a visual inspection system for pipe corrosion in plants that uses Human-in-the-Loop Machine Learning. We have enhanced the functionality of this system to enable it to work with various materials used in pipes. Furthermore, in plant status prediction, we are working in collaboration with research and manufacturing divisions to apply the effects obtained from data analysis at our production sites and drive continuous development.

We are realizing a higher level of plant operations through the SMART-FACTORY concept, as the introduction and utilization of these new technologies enable stable operations through prevention of accidents and equipment problems and improved efficiency in routine operations.

DX Management for the Realization of the SMART-FACTORY



● indicates systems using AI

Continuous Improvement of Responsible Care Activities

The MGC Group has been promoting responsible care (RC) for the environment, safety, and health for 30 years since 1995. Under the current medium-term management plan (MTMP 2026), we are continuing our companywide safety program, LINK, which started in fiscal 2021, and engaging in dialogue with Group companies to resolve issues facing each workplace. Companywide quality assurance activities (Q-MGC) will also shift toward supporting Group companies.

Ensuring Risk Management through HAZOP

The Company has experienced two explosive fire incidents: one at a manufacturing subsidiary in Thailand in 2017 and one at the Yokkaichi Plant in 2019. In light of these incidents, we determined that our past approach to preventative measures for emergent and latent risks was inadequate. To remedy this shortcoming and minimize risks related to occupational health and safety as well as process safety and disaster prevention, we conduct HAZOP process risk assessments on all manufacturing equipment.

Looking ahead, we will change our policy to thoroughly screen our existing equipment, as well as conducting HAZOP on new equipment as well. We will identify the potential risks in all equipment and quickly take appropriate steps to reduce those that are at an unacceptable level.

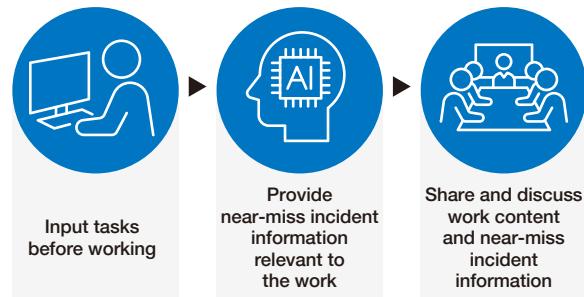
KY Suggestion System

While we are promoting the automation and operational stabilization of manufacturing equipment, a decrease in opportunities for employees to take action on the front

lines to carry out safety and disaster prevention activities is giving rise to concerns that employees' pre-work KY (*kiken yochi* ("hazard prediction")) level may decrease. To dispel these concerns, we have built the KY Suggestion System. The system uses a huge database of near-misses compiled through past near-miss reporting activities* to extract only the examples that relate to the work on-site for the day, and is able to effectively provide hazard prediction prior to starting work. The system has not only prevented human errors, but has also been effective for increasing employees' sensitivity to sources of danger. Going forward, we will look at fitting the system with new functions based on better hazard source data, using a large language model.

* An activity that encourages organizational disaster prevention by having employees report and share near-miss incidents that were alarming and left the employee feeling relieved as they did not end in accident or disaster.

Overview of the MGC-KY Suggestion System



Employee Comments

Adoption of DX Technologies in the Quality Assurance System, Starting with Super-Pure Hydrogen Peroxide

To maintain the high quality that customers demand, the Group has established systems for continual improvement based on companywide collaboration. This activity made an evolutionary step with commissioning of the LIMS quality data collection system at the Saga Plant in 2021.

The head office Environment Safety & Quality Assurance Division decided to install LIMS, which collects data from inspection equipment such as ICP-MS and feeds the data directly into an inspection system. The aim is to eliminate recording errors of test results in shipment testing and communication errors, and to minimize latent risks in the quality assurance system. The Saga Plant, which produces super-pure hydrogen peroxide, is leading this charge. Since the system has no precedent in the Company, it necessitated some hard work to carry out the process for defining requirements, ensuring the reliability of data collection and categorization, and to give consideration to usability. However, the introduction of LIMS has reduced the burden on employees, and has

also given us confidence in the reliability of test results. We continued to roll out LIMS at all plants, making use of the knowledge acquired through the installation in the Saga Plant, completing LIMS introduction to all plants and factories in Japan by March 2025.

Our job now is to promote the use of DX even further, through statistical analysis of data and linking with other systems, thereby contributing to new solutions to issues on the factory floor.



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