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SUCCESS STORY

# Improvement of Grade-Change Operation
# Japan Polychem Corporation, Kawasaki Factory

**Location:** Kawasaki, Japan
**Order Date:** April 1999 (Chidori area), February 2000 (Ukishima area)
**Completion:** 2000 (Chidori area), 2001 (Ukishima area)
**Industry:** Petrochemical

The Kawasaki factory of Japan Polychem Corporation is a multi-grade (300 grades), low volume production facility that manufactures high-density polyethylene and polypropylene. Approximately once a day, they are required to make a product grade change while keeping the process running.

Before introducing the Exapilot operation efficiency improvement software package, this change was manually done by operators. The grade-change operation was manually intensive with 100 - 200 manual adjustments and relied on the use of trend displays because of the multi step construction of the polymerization tank and due to short discharge times. To improve this situation, they initiated a project that would reduce the operator's work-load.

Since the skill level of each operator was different, there was a large variation in transition product volume ( +50% to -20%). As a result, there was also a need to quickly optimize operational procedures to avoid an impact to the production schedule. Upon a grade change, it was necessary to quickly match the properties of the product in transit to pre-defined targets, minimize overshoot control and to stabilize the process.

Although there were the above improvement requirements, grade-change operation at the Kawasaki factory had not been automated by the addition of a DCS. In the case of this complicated grade-change operation, it is necessary to revise the control configuration based on frequently changing products and different grade patterns. This type of operation and configuration of a DCS is very time consuming and requires constant engineering modifications. As the Kawasaki factory put a priority on the speed to practical use of the application, the automation of the process was neglected. On the other hand,since DCS application engineers do not have detailed knowledge of the process, it is difficult to build-in various operational expertise for this type of gradechange operation. For example, few engineers would know the proper relationship between different catalyst activity or the differences in the composition of several materials. Therefore, it was assumed that the automation of a gradechange operation could not meet the expectations of the operators. Also, it was assumed that the operation know-how learned as a result of continuous improvements and operator interactions would be lost with the introduction of a fully automated DCS solution.

Surprisingly, the Exapilot (UNIX version) software solution, release in June of 1998 and introduced in the Chidori area in 1999, was able to achieve all of these demanding requirements. Moreover, as Chidori area succeeded, Exapilot (Windows version), which was released in March 2000, was introduced in Ukishima area. Both UNIX version and Windows version are not redundant system, but it can be easily cut off from the DCS if anything should happen, and operators can keep operating continuously, so Kawasaki factory did not dispute it. The



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engineers at the Kawasaki factory did not resist this change when they learned that the program could easily be over-ridden or by-passed given the operators direct continuous control of the DCS. The Exapilot Windows version runs on a PC (WindowsNT4.0/Windows2000 for OS) and is enhanced by including an OPC (OLE for Process Control) communication interface with any OPC compliant application or control system. Exapilot provides the operators with icons that represent each work step and automates the operation in a flowchart format by putting and connecting these icons on a builder window based on best operation procedures. It was possible to dramatically reduce engineering time compared with using just a DCS or process computer because it eliminates the need for complicated formulas and make it easy to execute repetitive changes. Also, since the program is intuitive, it eliminates the need for special programming skills and operators can input their knowhow directly into Exapilot. The above mentioned flowchart is a graphic which display the progress of the operation represented by icon color changes but also allows manual intervention if necessary. In the case of another polypropylene plant in Ukishima area (Exapilot Windows version), skill-full operators and process engineers were assigned and spent about 7.2 man-months to implement more than 100 types of gradechange applications (operator 6 man-months, engineer 1.2 man-months). By introducing Exapilot, the following benefits were achieved.

1. Operators'workload was dramatically reduced (from 100-200 DCS manipulations to just two - start and stop)
2. Operation time was reduced as much as 10%
3. Transient products were reduced by an average of 20%
4. Engineering time was reduced to less than 1/10 compared to just a DCS
5. Operation know-how was shared by the operators and by others in all divisions
6. Operators'motivation was improved (active participation in the improvement of the operation)

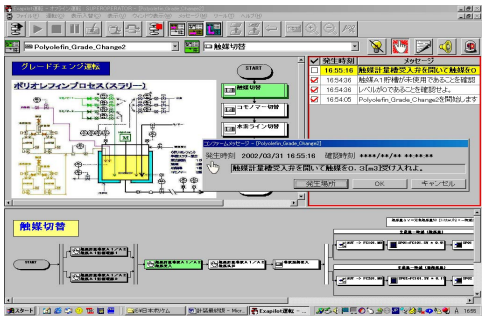
**Appendix ;**

Chidori area (introducing Exapilot UNIX version in May 1999)

- Polypropylene KPP3 89,100 tons/year
- High-density polyethylene KHD1 45,000 tons/year
- High-density polyethylene KHD2 50,200 tons/year

Ukishima area (introducing Exapilot Windows version in March 2000)

- Polypropylene KPP1 70,600 tons/year
- Polypropylene KPP2 67,000 tons/year



[Note]
The company name, the factory name and the plant capacity information are based on the data of June 2002.

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**System: CENTUM-XL (Chidori area), CENTUM CS 3000 (Ukishima area)**
**System Configuration: Exaopc + ECGW3 (Chidori area), Exaopc (Ukishima area)**