Brief overview of iron and steel production process

A blast furnace is charged with coke fuel and a limestone flux to melt and purify iron ore. The molten iron discharged from the furnace is transferred to a basic oxygen furnace (BOF) where the molten iron is further refined by the burning out of aluminum and magnesium and the addition of chromium, manganese, zinc, and other materials. The molten steel produced with this process is then transferred to a continuous casting line (CCL) for casting into billets, blooms, and slabs. The casted products are then reheated, rolled, and processed to form wire, bars, rods, hot-rolled steel plates, and hot and cold-rolled steel coils. Some of these products are subsequently subjected to value added processes such as galvanization or coating. Of the above upstream facilities, the blast furnace is the most important as it produces the high-quality molten iron needed to produce the high grade final products. To ensure the safe and stable operation of these production processes, a reliable control system is essential.

The No. 4 blast furnace was built in 1996 and has an effective inner volume of 3,400m³, a hearth diameter of 12.5 m, 32 tuyeres, and 4 tap holes, and can produce up to 7,000 tons of molten iron per day. In 2014, this blast furnace was scheduled to undergo its first major blow-down maintenance. Though CSC’s engineering and maintenance departments were dissatisfied with their existing control system’s stability and technical support, and both wanted to go with a Yokogawa DCS, the operators for blast furnace No. 4 insisted on staying with the existing system because they were familiar with it. Rather than giving up, however, Yokogawa Taiwan’s sales team demonstrated the use of actual blast furnace application programs and configured the CENTUM operator interface so that it closely resembled the existing DCS’s interface and thus offered an easier learning curve for the operators working at this blast furnace. An additional factor in CENTUM’S favor was the fact that it was in use at blast furnaces 1, 2, and 3, and had the high recommendation of the operators assigned to those units. Consequently, Yokogawa Taiwan was awarded the No. 4 blast furnace DCS project.
Collaboration for a successful system migration
The control logic for the process control system at blast furnace No. 4 was configured based on the know-how that this facility's operators and engineers had acquired over the 17 years that this facility had been in use. To prepare for the migration to CENTUM VP, the Yokogawa Taiwan project team had to work with the CSC engineers to understand the existing system’s control logic, as part of which they had to analyze piles of old documents. Based on CSC's requirements, they then successfully configured the control logic for the new CENTUM VP DCS. It is expected that the experience gained by Yokogawa and CSC in this undertaking will prove helpful when it comes time for the No.3 blast furnace to undergo blow-down maintenance.

Quiet and orderly central control room
For the three operators working each shift in the central control room, there are nine human interface stations (HIS). In addition, six 65" LCD panels are mounted on the wall facing the HISs to display information on the main processes and give operators and line managers all the information they will need to quickly and easily get a good grasp of process conditions throughout the facility.

Thanks to the engineering of the CENTUM VP system to suppress low-priority nuisance alarms by CSC engineers, the central control room is a very quiet and orderly place.

Remote monitoring and operation using the HIS terminal service
In addition to the HISs in the central control room, client PCs have been installed in key locations for the monitoring and control of facilities such as the blast furnace’s stave cooling system and tap holes. To ensure a robust and efficient environment for the use of these PCs, Yokogawa Taiwan also set up an HIS terminal service (TS) function for CENTUM VP and gave it a redundant configuration. Microsoft’s network load balancing (NLB) technology was also implemented to improve the reliability and performance of network communications. In addition to providing the TS function, Yokogawa Taiwan was able to reduce costs and improve system stability by using materials in the V net cables that were more resistant to corrosion caused by exposure to sulphuric acid. Loading on the V net bus was also reduced through the use of PCs, network switches, and Ethernet networking technology.

Customer Satisfaction
Comments from CSC’s project manager:
“The engineering environment of CENTUM VP is so intuitive that we can set all alarms by ourselves, easily. In addition, the HIS design is very user-friendly. The introduction of a graphical user interface and mouse pointing devices is a great improvement. We believe that the new control room provides a very user-friendly working environment for our operators.”

“Once adopted, a DCS has to control processes for well for over 10 years. Inferior operability leads to operator stress. With its superior operability and intuitive design, CENTUM VP is very operator friendly. Everyone who works with Yokogawa’s systems at this mill appreciates their user-friendly design.”

“With our blast furnaces, simple on/off control is done by PLCs, and the DCS is used to control crucial equipment such as process valves. The biggest advantage of the Yokogawa DCS is its function blocks. Using them, we were able to configure the blast furnace control functions without having to do any coding, and we believe that this will be an advantage whenever we have to perform maintenance.”

“Yokogawa Taiwan’s personnel provided high quality service and were very responsive. They demonstrated high-level technical expertise throughout this replacement project. Yokogawa products may be expensive, but they have excellent reliability. We trust that Yokogawa will continue working with us to provide good products based on an accurate understanding of our needs.”

For more Information and Contact
CENTUM-VP
System Migration and Replacement

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