

Operator training simulator accelerates learning

As technology becomes more complex and companies strive to do more with fewer personnel, having a highly skilled workforce is paramount. As a result, operator training simulators (or systems, OTS) have become imperative for manufacturing companies wanting to stay competitive in the 21st century. OTS are computer based training systems that use a dynamic simulation of an industrial process, usually integrated with a process distributed control system (DCS).

Providing a hands-on, process specific learning environment, designed to improve the skills of an operations workforce, leads to increased plant performance. Studies show that OTS improve operator effectiveness, providing increased company profits through better product quality, plant availability, and throughput. OTS also leads to increased plant-wide safety and increased energy efficiency.

These results are achieved by exposing operators to what they will experience in their actual control room, but in an off-line, non-intrusive environment. By giving operators the opportunity to gain an understanding of operating concepts, while learning their actual process, it prepares them to effectively handle potential incidents or process upsets once the plant begins production. This ability can produce significant and quantifiable results.

An API (American Petroleum Institute) study found there was a \$350 000 per year per operator positive financial impact when an operator was 'upskilled' from an average to an advanced level. Insufficiently trained operators are the single largest source of production losses. The better operators know the processes they are responsible for overseeing, the less likely they are to make mistakes.

An example of how an OTS has helped make a significant difference to the competence of opera-

tors and delivered safer, faster and more stable commissioning and start-up concerns a new lubricants plant in Cartagena, Spain.

The Iberian Lube Base Oils Company (ILBOC) plant, a joint venture between Repsol and Korean firm SK Lubricants, is the largest facility of its kind in Europe. The plant has a production capacity of 630 000 tonnes of Group II and III base lubricants, which are the raw materials for next generation lubricating oils that reduce both fuel consumption and the impact on the environment.

During construction of the €250 million facility, ILBOC identified a six-month period between the plant design and commissioning stages when it would be appropriate to provide DCS and safety instrumented system (SIS) training for all operators of the vacuum distillation and catalytic Isodewaxing units. Implementing training at this juncture would help to improve the subsequent commissioning process, ensuring the plant was brought online according to the planification and in a safe and efficient manner.

An Emerson DeltaV DCS had been implemented at the plant and, as part of the project, Emerson's OTS was selected to train and evaluate the competence of operators. In terms of training, ILBOC's primary objective was to provide operations personnel with a specific, identical and realistic offline environment for them to gain practical experience and familiarity with the DCS, SIS and process as a whole. It was also important to gain experience operating the process systems in various situations including start-up and shut-down, normal operations at different throughputs, recovery from various malfunctions and upsets, and emergency shutdowns. Finally, the training needed to help test and validate operating procedures, control strategies and logic, as well as support debottlenecking.

To help achieve these goals, Emerson provided ILBOC with both the OTS and supporting consultancy services. The OTS included a virtualised DeltaV system for process control and an integrated third party safety instrumentation system for process and emergency shutdowns. ILBOC

required medium fidelity modelling of the production process. To ensure consistent implementation, the process modelling was integrated into the virtual integrated control and safety system (ICSS) using SEEDS (Standard Entities for the Engineering of Dynamic Simulators).

Emerson's simulation engineers spent six months in Madrid building, designing and testing the OTS. The OTS provided a flexible architecture and integrated solution with all elements including the process model, ICSS control database and SIS logic within the same environment. As a result there was no requirement for additional integration work between control and safety systems using OPC communications. This minimised the complexity of the OTS design, thereby reducing project risk.

During the four-month on-site training programme, simulation based training allowed ILBOC operators to log hundreds of hours in a wide variety of situations. It also allowed them to widen their range of experience and instil confidence in handling many process situations. Personnel learned about both DeltaV system operating concepts and the actual process, preparing operators to effectively handle abnormal situations and process upsets, as well as providing decision support.

Emerson's OTS provided ILBOC with a number of benefits including reduced operating costs due to the ability to identify potential issues during

initial start-up, shutdown and normal operations. Having well-trained operators reduced plant start-up and shutdown time, and the production of off-specification product. Coordination between Emerson's OTS and DCS was key to the success of the project.

Energy consumption is a significant issue at process plants. The experience and understanding of the process gained through the training is enabling operators to identify potential problems such as loss of power failure or cooling water that would reduce the energy efficiency of the plant.

Conclusion

Emerson's OTS solutions and consultancy services were instrumental in helping ILBOC achieve their training goals and significantly improve knowledge transfer. By providing realistic, hands-on, process specific learning in a safe, controlled environment without any risk to plant personnel or operations, the DeltaV OTS exposed ILBOC operators to what they are now experiencing in their actual control room. Through the use of intentional malfunctions, scenarios, initial conditions, field operator devices and forced level entry the ILBOC workforce's learning experience was accelerated.

Emerson Process Management

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