Improving operations in continuous processes through procedural automation

Process plants require operational procedures in order to produce products. These procedures consist of a set of tasks that are executed in a consistent manner to achieve a specific objective such as starting up or shutting down, or transitioning to a different product. The level of detail, purpose and frequency of use of these procedures varies by process, company and site—but in all cases these procedures should be the basis for plant operations.

A 2008 survey by the ARC Advisory Group indicated that continuous process manufacturers see effective and repeatable transition management, along with the use of sequence-based operating procedures, as a competitive advantage. Additionally, process manufacturers agreed that the added safety gained when automating procedures should be assigned a high tangible value.

The cause of some recent industrial accidents has been linked in part to a lack of good procedures during an abnormal condition. This put too much pressure on operators in a crisis situation, leading to improper procedural operations and resulting in disastrous consequences.

Currently, semi-automated and automated procedures are not widely adopted in continuous processes due to a lack of general industry expectations and standards. But increased operational excellence has put more focus on increased safety, improved throughput and reduced cost—along with knowledge capture to retain years of operational experience that would soon be lost due to retirement. Procedural automation can deliver all of these benefits and more, leading to a strong interest from process industry manufacturers and the suppliers that serve them.

An example helps to illustrate the concept. An oil refinery in Japan underwent crude oil feedstock switches two or three times a week. The efficiency of the operation depended on the experience and skill of the board operator running the distillation unit.

With a skilled operator, the time to reach normal steady-state operations was typically five hours, but it could take more then eight hours with a junior operator. These extended transition times had a negative impact on product quality and production efficiency. With junior operators, there was also a higher incident of operational errors, resulting in abnormal conditions and off-spec product.

An automation supplier was called in to work with the operational staff at the refinery. They interviewed the board operators from different shifts, and were able to uncover and document best practices.

For instance, when ramping up feed temperatures, junior operators would typically ramp feed temperatures at a linear rate throughout the temperature zones in the column, but

veteran operators had the operational experience to ramp temperatures at different rates depending on the zone.

It was also discovered that operators typically had to make more than 100 adjustments to the process through the DCS system during the switchover. This was in addition to responding to false alarms that were set for normal operating conditions.

Implementing procedural automation enabled the refiner to make significant improvements in the switchover time to a predictable four-and-a-half hours regardless of which operator was on shift. The operators' workload was also reduced significantly, with over 100 control system adjustments reduced to 10, and more than 2000 process alarms cut substantially by configuring the system to be operationally aware of process conditions. Finally, there was increased process knowledge sharing, a significant reduction in operator errors and reduced required operator training.

In part due to success stories like this refinery, the need for a procedural automation standard has been recognized by industry. Consequently, ISA approved the formation of a new Procedural Automation for Continuous Process Operations standards committee in April 2010.

The purpose of the committee is to develop a standard, recommended practices and technical reports for the lifecycle of automated procedures for operations in continuous process industries. So far, the standard has had input and support from 39 manufacturers and suppliers, including many refining and petrochemical companies.

The committee has met face-to-face several times, and has held monthly teleconferences since June 2010. The initial goal is to publish a technical report in 2012 based on the best practices that are in use today. Following that, the committee plans to refine the material and publish a standard.

The published procedural automation standard will allow process manufacturers to implement a consistent approach to procedural automation across their facilities. This will deliver benefits in terms of safer operations, lower costs and increased product quality and consistency. It will also facilitate the transition from experienced to newer operators.

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