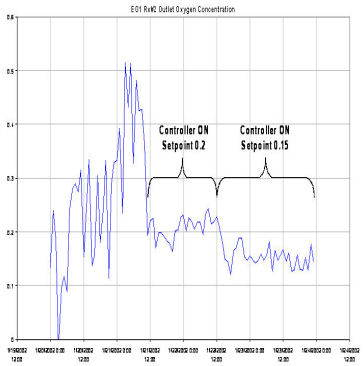
Chemical Plant Implements Advanced Process Control

The manufacturer implemented advanced process control (APC) to solve issues surrounding safety, ethylene oxide selectivity, and catalyst degradation in their reactors.



Main Objective

Plant personnel sought an improved control scheme that would ensure safe reactor operation while maximizing selectivity and extending catalyst life under widely varying process conditions.

Customer Results

Designing and implementing the new control system in a step-wise fashion led to a true understanding of the characteristics and dynamics of the underlying process, allowing the further inclusion of decoupling to compensate for multivariable interactions. The coordinated MAVERICK/customer effort resulted in dramatically improved reactor operation with measurable improvements in selectivity, reduced recycle, and extended catalyst life.

Application Description

The manufacturer struggled with proper control of their ethylene oxide reactors. Because improper reactor operation can lead to conditions in which the reactant concentrations violate explosion limits, operations personnel tended to run the reactor far from optimum conditions, which resulted in poor ethylene oxide selectivity and excessive catalyst degradation.

The total solution relied on four key applications:

- **Analyzer Input Validation & Selection**: Real-time process analyzers that measure individual chemical components in the reactor feed and product streams are essential for maintaining stable and optimum reactor operation. This unit was equipped with several analyzers, some of which were redundant. One phase of the MAVERICK solution involved the design and implementation of algorithms to validate each input and then choose which set of inputs to use for both closed loop control and for the operator advisory tools.
- **Inlet and Outlet O_2 Composition Control**: This is a set of constraint controls that adjust the feed O_2 flow rate to maintain the inlet or outlet O_2 composition near, but outside of, the explosion limits. This maximizes reaction selectivity and allows for higher production rates when called for.
- **Reactor Optimizer**: Trace amounts of a catalyst promoter are added to the reactor feed to maintain the optimum catalyst activity. MAVERICK first implemented an algorithm which estimates the concentration of this promoter in the reactor in real time. The team then designed and implemented a control to adjust the flow of catalyst promoter to maintain optimum concentration.
- **Catalyst Selectivity Visualization**: Lastly, MAVERICK designed and installed an application that gives the board operators a visual representation of how close to optimum conditions the catalyst is being operated. This provides guidance regarding adjustment of the reactor optimizer target on a day-to-day basis.

The MAVERICK Difference

MAVERICK's solids APC engineers worked in close coordination with the operations team to analyze the control problems, develop the new application in a step-wise fashion, and to design and implement an effective solution. The project exceeded customer expectations. The controls and tools have now been in place for several years.

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