

PRODUCT APPLICATION

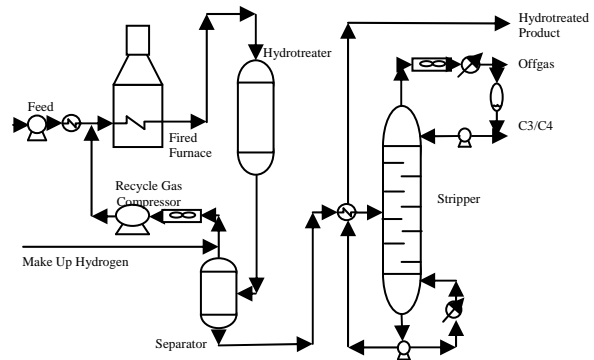
Process Industry - Run-Length Optimization

Turnarounds are the major maintenance activity for most refining, hydrocarbon, and chemical plants. They are costly both in terms of lost production but also in terms of the amount of money spent on actual maintenance. Too often, money is spent needlessly on items that pose relatively little risk of failure.

Business Aspect of Turnarounds

Plant business managers must ask some hard questions when considering turnarounds. For example:

- When do I turnaround Unit A?
- What is the impact if I wait X amount of time before turning this unit around?
- How long can I afford to be down?
- What equipment should be included in this turnaround?
- What is the risk of removing certain items from the turnaround schedule?
- What groups of units should be turnaround at the same time?
- How cost effective is this turnaround?



Clockwork Approach Based on “System-Wide” Risk Analysis

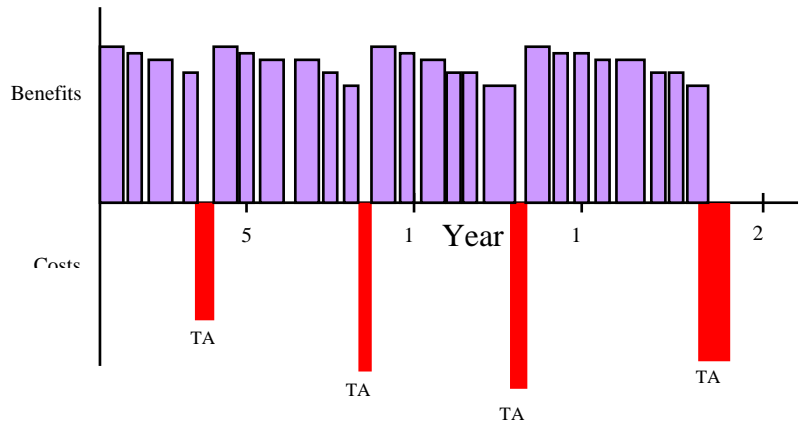
Until recently, many decisions surrounding turnarounds were based on experience and “rules of thumb”. While valuable, most of these estimates tend to be quite conservative – and hence costly. Fortunately, Clockwork has tools and technology that helps quantify those decisions.

As opposed to other risk-based methods, Clockwork’s approach is based on a system approach – not just the risk of failure on individual pieces of equipment. Of course, the Clockwork approach does include the individual failure risks into the overall evaluation, however what separates the Clockwork approach from other risk-based methods is that those individual risks are simulated at the unit level of a larger model to determine how the failure of one component affects the failure of the system as a whole. This provides a far more comprehensive view.

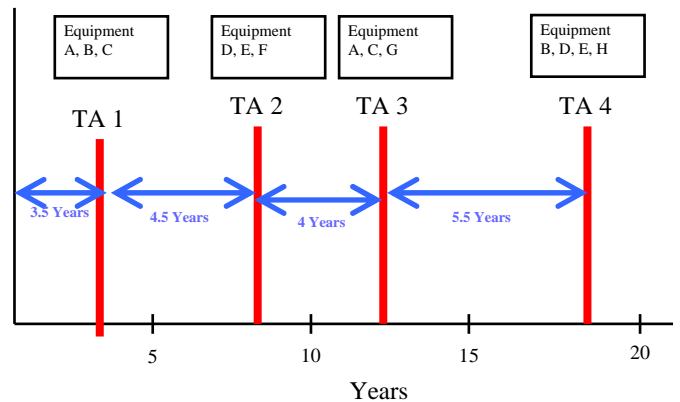
The Clockwork methodology is a combination of Monte Carlo discrete event simulation technology, various optimization technologies, along with, a healthy dose of expert process know-how.

Run-Length Optimization

Clockwork technology can be used to determine what equipment should be included in this turnaround based on a risk analysis and which equipment can be postponed until later. These techniques have also proved valuable in determining the optimal spacing between turnarounds.



Normally, the optimization objective function is to maximize profit over several turnaround periods. The optimization proceeds by choosing which major pieces of equipment to include for each different turnaround period along with the turnaround spacing. Throughput is then calculated for each turnaround period along with any yield decline. Failure data used is based on how equipment ages over time.



Clockwork Technology Compliments Other Turnaround Technologies



While powerful, Clockwork technology does not have to be a substitute for other tools used in detailed turnaround planning. Clockwork's high level value-added tools can be used in conjunction with other planning tools to add another dimension to long-term turnaround planning. It helps engineers, plant managers, and business people remove the guesswork from turnaround planning and instead allow decisions to be based on a reasonable system-wide risk analysis.

Contact: Email: info@clockwork-solutions.com
 Website: www.clockwork-solutions.com