CHEMICAL PROCESSING
LEADERSHIP | EXPERTISE | INNOVATION

Improve Your **Process Control and Operations**

PutmanMedia®

TABLE OF CONTENTS

AD INDEX

Reduce your carbon footprint without significant capital expenditure

Flare.IQ Advanced Flare Control Platform

- Increases efficiency of the complete flare system
- Certifies compliance to RSR 63.670
- Reduces implementation costs, time and risk
- Delivers smarter technologies for the planet

Access the free Steam Savings calculator online.

Panametrics
a Baker Hughes business

Make the Most of Migration

A methodical approach to control system modernization can optimize results

By Darryl King, JMP Solutions

Your goal: maximize the efficiency of your equipment while keeping costs under control. This sometimes translates to a modernization effort that will improve throughput by enabling decreased cycle times not feasible with current equipment.

A modernization project will help you reduce lifecycle costs. Old equipment gets more expensive to maintain over time and, if you upgrade, you'll decrease downtime by having systems that are easy to maintain and troubleshoot — ultimately improving your quality metrics and cutting scrap rates. What you certainly don't want is being forced to launch such a project because of an emergency.

Take the case of one company that was running a legacy system that included three of the nine controller units the vendor ever manufactured. No conversion utilities existed for the units, so every change required manual re-programming. Multiple legacy platforms, uncoordinated alarms that weren't tied together, poorly maintained documentation and lack of drawings meant the company continually faced the need for extensive engineering.

You should be looking for a roadmap to project success.

Suddenly, the equipment broke down and there was going to be a high price to pay to fix it. The company had a short window to perform a shutdown to replace process instrumentation and control elements while minimizing downtime. Moreover, to enhance operator acceptance of the new system, the company wanted to maintain the look and feel of the old one.

The company worked with JMP Solutions to evaluate several platforms and automation vendors. The project scope accounted not only for meeting current demands while maintaining existing screens for operators to minimize disruption but also for future-proofing equipment to ensure the opportunity for ongoing growth.

Coming up with the most-suitable solution required:

- an understanding of the situation and development of a comprehensive plan to eliminate downtime;
- extensive experience with programmable logic controllers (PLCs), drives, human/machine interfaces (HMIs), supervisory control and data acquisition systems, motion controllers and applications that meet the needs of the business such as manufacturing execution systems;
- a proven methodology and approach that is result oriented and provides clear metrics for project completion as well as a timeline;
- change-management guidance that can assist the entire company navigating through a major hardware upgrade with minimal disruption to work processes; and
- documentation and training so everyone on the team feels comfortable with the new systems and can operate them with maximum efficiency.

MAKE A PLAN

Of course, you shouldn't wait to migrate until an emergency forces your hand. Instead, you should approach modernization in a methodical way. First, you must assess your situation.

The key to successful migration starts with conducting a roadmap assessment where you identify the outcomes you want to achieve for your businesses. Often, this involves gathering operability reports, defining future roadmap goals, performing system and plant inspections, and using other management tools to collect information not only about the equipment but how it's used.

Throughout the process, you'll learn about automation options, services and the strategies needed to develop a project that is delivered on-time, on-budget, on-scope and with minimal risk. Initial discovery discussions should point to key performance metrics, clarify next steps and the kinds of solutions to deploy to effect change.

You should be looking for a roadmap to project success. What tools do you need to employ? What is the timeline for project implementation, including when must you plan for downtime and how can you minimize the impact on your business? In addition, the timeline should specify a target date for project completion.

The roadmap assessment also can work through potential operational issues and, in turn, prioritize your business outcomes such as how your project will impact yield improvement, energy management, efficiency tracking, compliance and supply chain coordination. Analysis and prioritization of these desired business outcomes will provide the context that will drive project scope and related equipment.

The roadmap also should contain a project plan — which might include multiple stages that correspond to an engineering specification as well as lifecycle support. This could involve greater manufacturing flexibility through scheduling of multiple products on the same process equipment and simpler regulatory compliance through elimination of a process waste stream.

Take the case of a company that was looking for an integrator to deliver a project and ongoing controls implementation support over a 21-year period, covering new unit installations and upgrades of existing systems as they complete their lifecycle. In addition, the integrator needed to provide consistent support on all levels, including project, expansion and upgrade, and extension of staff.

The plan was to evaluate the existing controls set-up in one facility with the aim of increasing product throughput and quality as well as support of a major system upgrade and conversion to some new applications and ensuring their compatibility with the controls architecture. The operating company decided to use this opportunity to expand the project scope by including a second complete process train that required ongoing system and process additions, upgrading of legacy controls, integration of system batch data with enterprise resource planning software, and support for site migration.

Here, the presence of full-time staff who understood and had specific expertise in the controls architecture of the company eased project implementation.

The results were impressive: increased throughput and yield with the addition of multiple trains and process controls that manage the product batches; greater flexibility through scheduling of multiple products on the same process equipment; simpler regulatory compliance by elimination of a waste stream; and decreased time to value and project risk due to controls being delivered on time and to specification.

A big piece of the upgrade process is to ensure that, if you're not maintaining a controls expert on staff to continually assess and work through your control system architecture lifecycle, you're training your team with best practices. This might entail arranging for some ongoing support, even on a sporadic basis, from the integrator involved in the project.

UPDATE DOCUMENTATION

That training must involve a documentation project. You must upgrade your documentation when you upgrade your systems. One polypropylene producer was looking to find a partner that could provide primary distributed control system (DCS) and PLC support for one of its North American plants. This included updating and enhancing control system documentation to support maintenance and ongoing troubleshooting.

The company needed multiple PLC installations on plant auxiliary systems, replacing relay-based controls with HMI PLCs. In addition, the project had to provide support of the company's existing system that controls the polymer reactors and extruder, field audit, verification and development of 500+ loop drawings in preparation for a major PLC migration. So, a follow-up project was launched to update all plant process control and logic drawings.

The plan also involved work on migration of an aging compressor control system as part of an initiative to upgrade several legacy PLC-based auxiliary systems. The control system modernization project led to increased throughput through process debottlenecking and upgrades. Moreover, the company realized greater product yield and quality by replacing aging polymerization tracking software. In addition, more-consistent availability of process feedstocks and decreased time to value and lower project risk via efficient project management resulted in better production schedule alignment.

What's included in a documentation project might seem obvious. However, every step you take in this migration must be written down and photographed or diagramed — whatever "illustration" you think will suffice for a person or team that wasn't involved in the migration to do it again. Adding a "scribe" to the project team often is a good idea; otherwise, task someone on the team with that activity. No point is too small to document. Again, think about it as if you weren't involved in the project. Is the documentation adequate to enable you to replicate the work?

Choose a simple way of documenting — via paper or common computer spreadsheet, presentation or collaboration software — whatever your company is most familiar with from a sharing perspective. Also, store every document in an area or system accessible only to those who need it. Online retention is best, especially if a company has multiple locations.

While documentation is important, you also must factor training into your plan and your timeline. You should train your personnel on both the equipment and process that you're automating, even if you have contracted with an integrator for support.

Often an integrator will possess specialists with expertise in your industry and experience with how automation systems perform in the process. They can add their knowledge of the equipment and play a critical role in partnering with your team, maintaining the system and making changes in it throughout the migration as well as after the project is complete.

AVOID THE POTHOLES

A number of issues might throw your project off track. Here are five key causes of failure during migrations:

1. *Lack of sufficient understanding of the migrating equipment, including sub-systems, attached equipment, communications (device and system level), and specialty hardware.* Expertise not only in the equipment you are installing but also in the equipment you are replacing is critical. How can you replace a system if you don't know what it did and how? Ensure you have the technical diagrams/documents on hand as you begin this migration and, if you don't know exactly how that system worked, find out!
2. *Flawed timeline for execution, weeks versus weekends.* Detailed planning helps determine the best path forward. Often a project lasts longer than anticipated, so be realistic or ensure your integrator is realistic about what you must do to get this project completed and how long each step will take. Stage-gate analysis is critical in any complex project; performing these analyses at crucial points along the migration timeline ensures the schedule is as realistic as possible. It also imposes a formalized risk identification and mitigation process on the project, allowing application of countermeasures at the earliest and most-cost-effective point.
3. *Inadequate maintenance and operator training to support the new system.* There's nothing worse than converting your system just to have it unsupportable with your internal resources.

While documentation is important, you also must factor training into your plan and your timeline.

4. *Absence of fallback planning.* It's critical to have a means to undo what you did should an emergency arise — so the plant can continue to operate. As previously discussed, documentation is key. You must document every step of the migration — what you did, how you did it, when you did it, and why you did it. That way, if you have to step it back, you can do so methodically without "breaking" the process.
5. *Poor spare parts inventory.* Having essential replacements on hand is important to this process as well, especially after the migration, because the new equipment isn't necessarily stocked internally. A bill-of-materials review always should take place before milestone migration dates are set. This review will reveal which parts might fail first, so that you can cross-reference useful life expectancy with availability and lead time on a per-part basis to develop a preventative-maintenance-driven in-house spare parts strategy.

WHERE TO TURN

Any company looking to embark on an upgrade project should consult with some of the certification associations that can provide information on the backgrounds and experience of integrators you're considering. In the case of hardware upgrades, the Control System Integration Association, www.controlsys.org/, is a critical resource to help ensure you use an integrator that delivers top-notch results.

In many cases, besides offering expertise on various manufacturers' systems, an integrator can provide specific chemical industry knowhow related to processes that will help in assessing your situation. By using the firm's specialists as an extension of your staff, you can take advantage of their knowledge and insights to minimize the learning curve needed for your personnel.

Most importantly, you want to ensure you're evaluating an integrator on its ability to understand the outcomes you're trying to achieve for your business. Increasing quality, throughput and safety; decreasing cost and risk; and positively impacting time to market are just a few results that should top your lists. Some integrators offer an onsite roadmap assessment. It's a good way to get things started. ●

DARRYL KING is director of sales, control systems and AGVs for JMP Solutions, Cambridge, Ontario. Email him at DKing@jmpsolutions.com.

Improve Distillation Control

Three design changes can reduce energy, improve capacity and prevent off-spec product

By Charles Herzog, Guest Contributor

Designing a distillation system to consistently achieve a given capacity at specified product purities involves more than sizing equipment and pipe. Feed changes, equipment constraints, uncontrolled disturbances, and periodic analyzer downtime can result in significant variations in product compositions (i.e., large standard deviation, σ). For this reason, it's common to set target product purities significantly higher than specifications.

The choice of operating target typically is driven by factors such as:

- Performance record of similar units with a given operating target;
- The magnitude and frequency of anticipated disturbances (e.g., during furnace decoking on ethylene plants);
- Whether off-spec product is flared;
- The priority placed on quality and reputation as a supplier; and,
- Whether customer is willing to buy off-spec product.

Selling off-spec product at reduced prices can be a bad idea.

If off-spec product must be flared, or an off-spec event requires a plant shut down, a large operating cushion (4σ or more) may be necessary. Often, supplying on-spec product outweighs all other requirements.

A track record of uninterrupted on-spec production enhances a supplier's reputation, leading to a competitive advantage, including higher prices to customers. Conversely, selling off-spec product at reduced prices can be a bad idea. This tarnishes the supplier's reputation and makes it difficult to sell on-spec product at full price. Customers may wait for an off-spec incident to buy at cut-rate prices.

Reduced variation (i.e., smaller σ) helps shift the composition operating target toward the product specification. This decreases heat loads and reflux requirements per unit feed, which improves energy efficiency. It also increases the capacity of the distillation system. Three important design improvements can reduce the variability of primary product composition:

Insulate overhead equipment and piping. This greatly decreases the impact of distillation's most unforgiving disturbance, the summer rainstorm. Insulation isn't a safety requirement on many distillation overhead systems, nor is it necessary for energy conservation in steady-state conditions. However, at the onset of a summer rainstorm, cool raindrops fall onto hot metal equipment and piping, causing a sudden increase in condensing duty and a rapid drop in pressure. Equilibrium liquids on trays vaporize, often leading to off-spec product and several hours of unsteady operation. Operators and the automation systems — even advanced process control systems — often are powerless to keep the system on-spec during and immediately following rainstorms in the absence of overhead insulation.

Increase holdup time for primary product. This is a guaranteed way to reduce product composition variation. A larger overhead accumulator or tower bottom serves as a product protector, dampening temporary upsets, regardless of cause, giving the operator time to make adjustments. Of course, a larger accumulator costs more than a smaller one, but the incremental cost is typically small compared to the cost of a single off-spec

Feed rate disturbances to a distillation system must be addressed.

incident. Furthermore, a larger accumulator may eliminate the need to buy an off-spec tank.

The oversized accumulator (or bottoms) may be crucial if the distillate is the primary product and the feed is vapor phase. In this case, the tower overhead composition almost immediately reflects any change in feed composition. Similarly, if the bottom is the primary product and the feed is liquid, any change in feed composition goes directly to the bottom product.

Increase size of upstream vessel to dampen feed rate changes. Feed rate disturbances to a distillation system must be addressed. Unsteady feed leads to unsteady product. Increasing the liquid residence time of an upstream drum allows more time for the level controller to dampen feed rate changes. If a smaller drum is exposed to large feed rate changes, more-aggressive controller tuning is required to prevent overfill; this can lead to oscillations.

More opportunities for improving column control and saving energy, including enhanced regulatory process control strategies and the use of inferential process models, are discussed in C. Herzog, "Address Distillation Process Control During Design Phase to Save Energy and Increase Capacity," AIChE Southwest Process Technology Conference, Sugar Land, Texas, October 1–2, 2019. ●

CHARLES HERZOG is a process consultant with 40 years of experience in oil refining and petrochemicals, including all phases of plant design, startup and operations. Email him at chasherz@aol.com

Fight Flare Inaccuracies

Accurate flare measurements are crucial to keeping a plant running efficiently

By Lei Sui, Panametrics

Flares in a refinery, liquefaction or chemical process plant are first and foremost a safety device. In many countries, it is required that the flare be monitored to assure pollution limits are not exceeded. However, a flare metering device also can be used to help plants operate with greater efficiency, leading to cost savings, even in the absence of regulation.

An accurate and reliable flare measurement can identify problems before they become crises. When installed and maintained properly, an accurate flare measurement can save an operator thousands of dollars in its first months of operation and pay back any flare flowmeter investment in fewer than six months. A properly installed flare monitor not only makes good environmental sense, but it makes good business sense.

THE IMPORTANCE OF ACCURATE FLARE MEASUREMENT

Consider a case of a flare that is operating with 80% methane. At flows of 200 m^3/hr or only 0.2 ft/sec on a 42-in. flare, without an accurate flare measurement, the operator might think that there are no process leaks and everything is operating correctly.

Over the course of a six-month period, this would mean a loss of 692,000 cubic meters of methane, or about $46,000 at a market price of $1.90/MMBTU. If the flare flowmeter is not installed correctly or is inaccurate, unstable or simply unable to resolve low flow conditions, the plant may be wasting a considerable amount of money.

MEASURING BALANCE OF PLANT

Plant operators also can use the molecular weight output on a GF flare meter to help assess whether a particular process is contributing excessively to a given set of flow conditions or as an important tool for measuring plant balance. The use of molecular weight as a diagnostic tool can be invaluable for isolating process leaks quickly so that actions can be taken to correct the problem.

COMPUTATIONAL FLUID DYNAMICS

Additionally, many flare installations from five or 10 years ago have undergone changes to piping layout, flow dynamics or process conditions. These flare meters may not be reporting the flow conditions accurately due to piping changes or added flows that may be contributing to flow profile degradation.

By using computational fluid dynamics (CFD), a model of the fluid flow in the reconfigured piping can be performed and correction factors can be determined to produce more accurate measurements. A full-service agreement that includes a flare CFD improves the overall performance of the flare meter by understanding and accounting for the actual flow profile under the current process conditions better.

A CASE STUDY

In the early 1980s, a flare gas ultrasonic (a high frequency sound) flowmeter first was jointly developed by Panametrics, a Baker Hughes business, and Exxon (now Exxon Mobil) in Baytown, Texas demonstrating great success. Since then, ultrasonic flowmeters have been gaining more popularity for flare gas measurement, mainly because of the high turndown ratio, relatively low installation and maintenance costs, the capability of handling unsteady flows and the independence on gas composition.

In addition, ultrasonic flowmeters are capable not only of measuring flow velocities, volumetric flow and mass flow, but also of producing a list of valuable diagnostic parameters, such as sound speed, signal strength and molecular weight, which are useful for prognostics, preventive maintenance and process defect identification. Ultrasonic flow metering has become an accepted technology for monitoring flare gas, with more than 5,000 installations worldwide. ●

LEI SUI is senior product manager at Panametrics and can be reached at Lei.sui@bhge.com.

WWW.CHEMICALPROCESSING.COM

CHEMICAL PROCESSING

LEADERSHIP | EXPERTISE | INNOVATION

ADDITIONAL RESOURCES

EHANDBOOKS

Check out our vast library of past eHandbooks that offer a wealth of information on a single topic, aimed at providing best practices, key trends, developments and successful applications to help make your facilities as efficient, safe, environmentally friendly and economically competitive as possible.

UPCOMING AND ON DEMAND WEBINARS

Tap into expert knowledge. *Chemical Processing* editors and industry experts delve into hot topics challenging the chemical processing industry today while providing insights and practical guidance. Each of these free webinars feature a live Q&A session and lasts 60 minutes.

WHITE PAPERS

Check out our library of white papers covering myriad topics and offering valuable insight into products and solutions important to chemical processing professionals. From automation to fluid handling, separations technologies and utilities, this white paper library has it all.

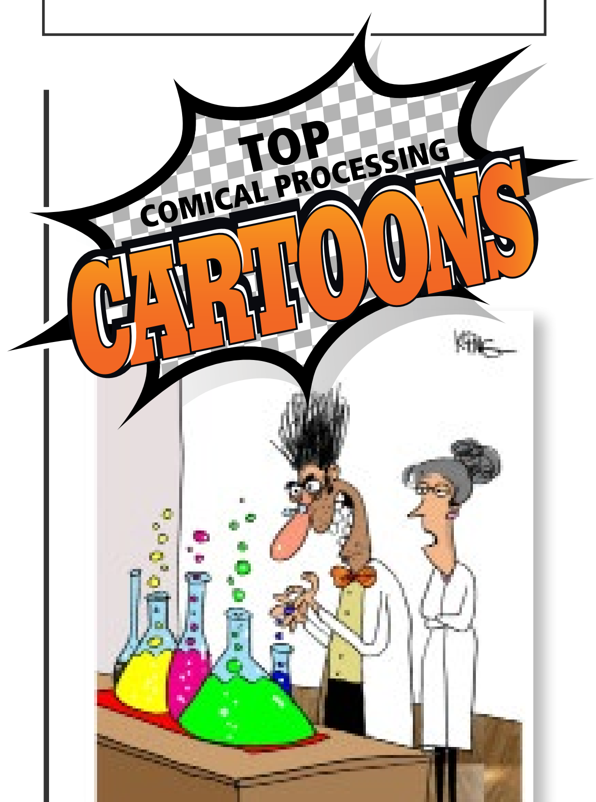
PROCESS SAFETY WITH TRISH & TRACI

Trish Kerin, director of IChemE Safety Centre, and *Chemical Processing*'s Traci Purdum discuss current process safety issues offering insight into mitigation options and next steps.

ASK THE EXPERTS

Have a question on a technical issue that needs to be addressed? Visit our Ask the Experts forum. Covering topics from combustion to steam systems, our roster of leading subject matter experts, as well as other forum members, can help you tackle plant issues.

JOIN US ON SOCIAL MEDIA!



Visit the lighter side, featuring drawings by award-winning cartoonist Jerry King. Click on an image and you will arrive at a page with the winning caption and all submissions for that particular cartoon.