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Make the Most of Your First Turnaround

Equipment inspection will teach things never learned in college

By Andrew Sloley, Contributing Editor

FIFTY years ago, process plants routinely shut down annually or even more often for scheduled maintenance. Today, however, an increasing emphasis on reliability, including more condition monitoring and predictive maintenance, means plants frequently run for 4 to 10 years before having to shut down. So, when a turnaround arrives, it may be the first one for much of the staff.

Engineering schools rarely mention, even once, maintenance requirements. So, the first turnaround you go through provides a tremendous opportunity to learn. It allows you to better grasp how equipment is put together and what common problems in your facility look like. Also, it gives you the chance to use what you know to improve the plant.

The maintenance and inspection department, which plays a key role in a turnaround, has that name for a reason that becomes crystal clear during the turnaround. Servicing of equipment usually demands careful inspection, including of mechanical integrity.

With so much to be done in such a short time, you, despite your inexperience, likely will get drawn into equipment inspection. To do it well, plan and prepare.

Move your thinking past just returning equipment to an “as new” or a “just like the drawing” installation. Field review of equipment should cover initial entry or disassembly, maintenance in progress and final review before closure. Perhaps your

observations will suggest modifications to the equipment.

To prepare for your turnaround role, develop a checklist for each item you must inspect. This checklist will vary depending upon equipment type but should include the following:

1. **Condition at shutdown.** Is the equipment damaged, fouled or in some unusual state? Where is the damage or wear? Erosion near a shell inlet nozzle of a shell-and-tube heat exchanger may indicate high inlet velocities through the nozzle. Are unexpected process conditions the cause? Will installing an impingement plate or switching tube metallurgy avoid such erosion in the future?

2. **Planned maintenance.** Is the aim to repair damage found or to make modifications? If modifications are intended, what are they and what are the critical factors (type, materials, dimensions, etc.)? List all modifications on your checklist.

3. **Dimensions and things to check.** Include crucial installation measurements and tolerances — for example, layout dimensions for a new type of distillation tray.

4. **Measuring tools.** What tools do you need and do you know how to use them? For instance, would go/no-go diameter gauges help you more quickly check a distributor in a reactor? Is a tape measure suitable for checking the height of a drum overflow weir?

Take pictures every time you inspect something.

5. **Special installation procedures.** Are unusual steps necessary? For example, some filters using bulk media (sand and other fill) require a particular loading protocol. The initial layer of fill on the support screen often must be a specific size, hand loaded, and then checked after 12–24 hours to confirm no leaks through the screen. Only then can the rest of the media bed be added. Your checklist should include all these steps along with test acceptance criteria.

6. **Final check.** Is such a check required before equipment closure? Who will do the check? Who will take responsibility (signoff) on the check?

7. **Schedule.** The checklist must include the planned schedule of all your inspection activities. The schedule should identify the time and duration of inspections. It helps you know where and when you will be needed — and also identifies potential conflicts.

At every point, inspect with your mind, not just your eyes.

8. Safety requirements. For each inspection, you must know what safety equipment you need and where to get it. Are you trained to use it? Do you have the required training for all your activities, e.g., confined space entry, fall protection and identifying special hazards?

When you go to perform the inspections, bring a camera (after, of course, obtaining any necessary clearance and meeting any other requirements for camera use). Take pictures every time you inspect something; don't hesitate to photograph inside equipment. You undoubtedly will find these pictures useful latter on. Any time a question comes up about the equipment or installation or for troubleshooting, photos are invaluable. Moreover, they can clarify terms in inspection reports subject to different interpretations, such as what "heavily fouled" actually means.

Finally, remember that inspection involves more than just going down your checklist. At every point, inspect with your mind, not just your eyes. Ask — even if an installation perfectly matches what's called for in the drawings — does this equipment layout make sense? Why is the installation being done one way instead of another? Inspection is the last chance to ensure the plant works as needed. Don't squander the opportunity. ●

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Get Production People to Accept Your Ideas

Explaining the engineering and science basis often is counter-productive

By Dirk Willard, Contributing Editor

The production manager scolded me: "It's not rocket science." He ran a simple operation and expected a simple answer. I thought to myself, "It is if you want it to work," but didn't dare say that. So, I carefully explained the scope in simple terms using kitchen-level physics. He got it.

I've encountered such situations many times. Indeed, one of the biggest challenges facing engineers is explaining complex physics and chemistry to production people. Sometimes, though, the real question is: Does the company really need an engineer on-site at all?

Consider the assignment I recently completed at a small facility in Cincinnati. The site blends and reacts materials to create products for the home and industrial markets. It uses air-diaphragm pumps to send materials mainly through polyvinyl chloride piping; there are no controls except weigh scales and virtually no process instruments. The place really doesn't require an engineer unless an expansion is planned. Moreover, it hardly needs maintenance. For this type of facility, the corporation should contract with a local engineering firm to provide the necessary support to the maintenance manager.

However, problems can arise when plant personnel make minor changes on their own. The Cincinnati facility badly messed up its piping because staff didn't understand water hammer, hydraulics, rheology, process control, material selection and other fundamentals. The plant would have benefited from a construction manual developed by corporate engineering.

Earlier in my career, a major brewer hired me to help out at one site. The maintenance manager there relied on the original plant construction specifications. He was a smart guy so he knew his limitations. When he had large projects, he could turn to corporate engineering.

So, why did the brewer hire me? Well, for several reasons — the best being because it planned to make several changes before selling the plant to a competitor but also because of a lack of honest engineering.

What is honest engineering? Well, let me tell you about Dr. Death. He was the corporate engineer. He specialized in selling projects to management at cut-rate prices. The guy I worked for in Cincinnati was like that, too. Then, some poor soul would have to do the work — and would fail; Dr. Death claims another victim. Honest engineering means providing a fair cost estimate including a little padding, which is almost always justified. A defensive strategy that can work if you're his potential victim is a well-documented project file and a bunch of update presentations. You want management to know exactly how much things cost.

So much for the digression, let's get back to how you should explain complex physics and chemistry to production people. Fortunately, modern technology helps a bit. When I had to spell out why installing a center-mount agitator without baffles was a bad idea, I made a video of the particular agitator to show it in action and downloaded a YouTube video of beads in motion in an agitated tank. The reaction: everyone understood baffles were necessary.

However, you can't explain some concepts to production — don't even try. Some years ago at an inorganic chemicals manufacturer, I tried to show how raising the temperature in a particular part of the brick lining of a chlorine fluidized bed would improve the lining and shorten construction time; my presentation, even with all its graphs, fell flat. The production people still didn't get it. So, instead, I made my case with maintenance but that group wouldn't accept my change without approval from corporate or production. My idea got nowhere.

I ran into a similar problem trying to explain how metal fatigue was the cause of spectacular failures in our oxygen coils. I learned something though: forget about selling production and maintenance on your ideas — go right to corporate engineering. If corporate agrees with you, production and maintenance must go along. The next time I ran into a challenge in replacing a Monel valve in oxygen pipeline service with one made of Type 316 stainless steel; it would avoid a long delivery delay as well as save a significant sum. I worked up a good case, bypassed the plant and went straight to corporate engineering. We developed a consensus among the maintenance engineers and the deed was done.

DIRK WILLARD, contributing editor, dwillard@putman.net

Win by Planning to Fail

Follow the lead of Warren Buffett to bolster prospects for project success

By Dirk Willard, Contributing Editor

Everyone probably has heard Benjamin Franklin's sage advice: "By failing to prepare, you are preparing to fail." It has a corollary: "By failing to prepare for failure, you will fail." This has been an underlying theme in several of my columns: http://goo.gl/a5OJIK; http://goo.gl/fS7Zcz; http://goo.gl/KuNwvE; and http://goo.gl/YpUAQI. You should take this admonition to heart. Why? I can point to many projects that ran into the ground because they were conducted sequentially as if every little decision made today didn't affect those made in the past.

Warren Buffett is famous for his solid advice on many matters, including planning for failure: "Risk comes from not knowing what you're doing." "Failure comes from ego, greed, envy, fear and imitation." And, "It takes 20 years to build a reputation and five minutes to ruin it." Buffett certainly isn't alone in offering good advice on planning. Admiral Hyman Rickover, the father of the nuclear navy, put it succinctly: "Success teaches us nothing: failure teaches." For more sound advice from him, check: http://goo.gl/lxb5MT.

Because I'm in the business of giving advice, I'll add some pointers of my own. First, planning is only a small step in the right direction. As Buffett notes: "Predicting rain doesn't count. Building arks does."

Here's one tip from me: Appoint a committee at the conception of every major project to review choices made during the design and grade them by risk. Then, establish resources for countermeasures against risks deemed

Encourage an environment where people feel free to challenge a design basis.

significant — which I consider ones that can delay commissioning more than 12 hours or cost more than $200,000. Set your own standards, if you like. For a small project, say one under $100,000, have another engineer review your project for risk. This may not suffice to avoid failure, though, especially if management doesn't support planning to fail.

Here's another: Encourage an environment where people feel free to challenge a design basis. Rickover recalled an admiral who wouldn't promote a subordinate because that person didn't query the admiral's actions enough. Part of the reason why companies hire smart people is to question conclusions. If your company fails to meet schedules and frequently over-runs budgets, perhaps it's because the corporate environment punishes people who criticize project details. Or, as Rickover once said: "The devil is in the details but so is salvation." The human resources (HR) department should actively evaluate manager performance on projects and product development — and I don't mean after the fact.

That brings me to my next suggestion: Conduct post-mortems. Even the most successful projects — the 30% that actually meet the original scope, budget and schedule — can provide examples for improvement. The committee reviewing the project ideally should include representatives from HR and upper management. Take a page from the co-founder of Sony, Akio Morita: "I believe one of the reasons we went through such a remarkable growth period was that we had this atmosphere of free discussion." Be frank and honest, not kind, during the post-mortem for a project that was really fouled up! Try to find the root cause of mistakes in design, construction, commissioning and hand-over.

As with many things, timing is important. Don't delay the post-mortem until a year after production starts. Instead, perform it after the process has been running for several weeks; this allows observation of issues in reliability, corrosion, product quality and production capacity.

The need to plan for failure applies not just to established companies but also to startups, as a relatively recent article in *Entrepreneur* magazine "Why Entrepreneurs Should Plan for Failure, Not Success," http://goo.gl/w6vPso, underscores. ●

DIRK WILLARD is a contributing editor for *Chemical Processing*. He can be reached at dwillard@putman.net.

Improve Hazmat Shipping Procedures

Four tips can help solidify supply chain relationships

By Roger Marks, Lion Technology

The American Chemistry Council estimates that increased chemical production will result in 1.8 million more annual chemical shipments in 2020. With the number of shipments increasing, demand for freight movers quickly is outpacing availability.

Challenges such as a driver shortage and restrictive hours-of-service (HOS) requirements mean that hazardous materials carriers now are more selective about who they work with. Electronic logging devices (ELDs) are mandated as well, meaning drivers cannot afford to wait for a shipment to be loaded. Every minute is accounted for, and every minute counts.

Finding drivers with the proper credentials, including a hazardous materials endorsement, also is an ongoing challenge. These difficulties make it critical that chemical shippers work to become "shippers of choice," a concept that's emerged to describe shippers whom carriers can rely on to offer shipments on schedule, in full compliance and without delays.

For chemical shippers, hazardous materials compliance can be a tool to gain a competitive edge and ensure that reputable, reliable supply chain partners want to work with you.

1. KEEP HAZMAT TRAINING UP TO DATE

The U.S. Department of Transportation requires hazmat training for all employees who affect the safety of hazardous

materials in transportation, and re-training is required once every three years. Employees with lapsed hazmat training may not perform their normal hazmat job functions, be it packaging materials, affixing marks and labels, handling shipments, loading or even filling out shipping papers.

If you don't have enough trained employees to do the work it takes to prepare hazmat for transport properly, shipments will be delayed. This can lead to wait times that drivers want to avoid.

With a well-trained workforce behind each shipment, drivers can accept hazardous materials confidently without worrying that an incident or release will slow them down a few miles down the road.

Note: For international chemical shipments, fluency in the International Air Transport Association's Dangerous Goods Regulations (IATA DGR) and the International Maritime Dangerous Goods Code (IMDG Code) is a must. Air and vessel shippers are responsible for compliance with unique, additional provisions to ensure safe transport by those modes.

2. REVIEW YOUR SHIPPING PROCEDURES

Hazardous chemical shipments that are packaged, marked, labeled or documented incorrectly result in delays — delays that shipper and carriers cannot afford in today's transportation environment. If packages, containers or tanks fail in transit, the costs can be devastating, and not just from the standpoint of lost time.

From damaged freight to highway closures and emergency response, a hazmat incident has enormous effects on supply chain efficiency. By keeping your procedures up to date with the latest regulations and best shipping practices, you can ensure your shipments are loaded and delivered safely and on time.

3. STOCK UP ON COMPLIANT HAZMAT LABELS AND PLACARDS

Hazmat labels and placards play a monumental role in the safe transportation of hazardous materials. In the United States, the 49 CFR Hazardous Materials

Regulations (HMR) require hazmat shippers to properly mark and label all packages containing regulated materials.

Proper hazmat labels also are mandatory under international requirements such as the IATA DGR (for air shipments) and the IMDG Code (for vessel shipments).

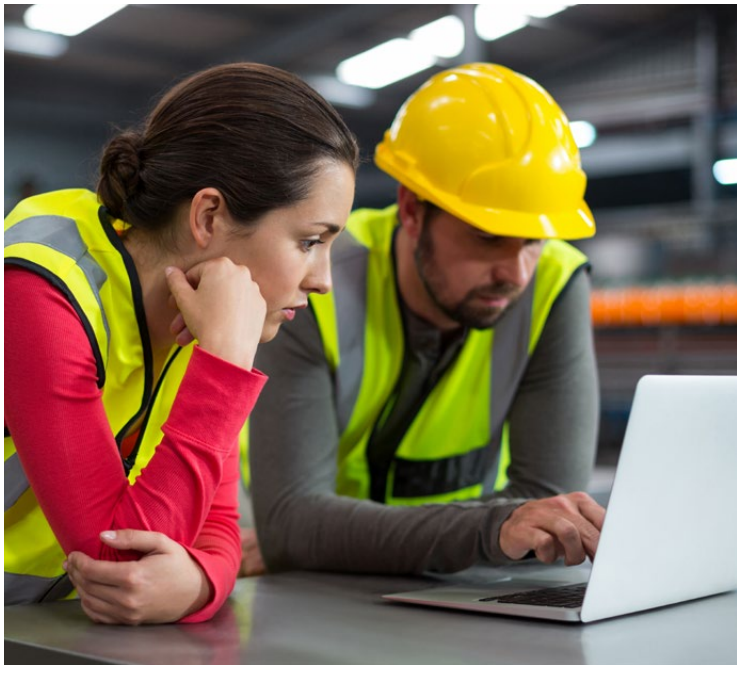
Hazmat labels and placards inform employees, emergency responders and supply chain personnel about the hazards and volume of the materials in the package. In an emergency, this information helps responders protect themselves, plan the response and effectively bring the hazard under control.

When you use the right labels, you not only comply with domestic and international regulations, but you also show your carrier that you're committed to safe practices that protect drivers and prevent delays in transit.

4. CHECK UP ON YOUR HAZMAT SOFTWARE SOLUTIONS

One strategy that shippers use to gain efficiency in their hazmat shipping operations is to use software solutions that create shipping papers, illustrate proper packaging and help ensure overall compliance.

Shippers should check to ensure these solutions are operating from the latest versions of applicable regulations such as 49 CFR,



the IATA DGR and the IMDG Code. If the software is outdated, it may be providing inaccurate or incomplete information.

Again, reliable hazmat training plays a critical role. If your organization lacks the knowledge to verify compliance, employees may become overly reliant on a software tool or be unable to answer questions about compliance from your carrier.

Carrier relationships and trust are critical in the freight market, especially when you ship hazardous materials. By taking steps to become a hazmat shipper of choice, you can help ensure carriers are available to haul your shipments when you need them most. ●

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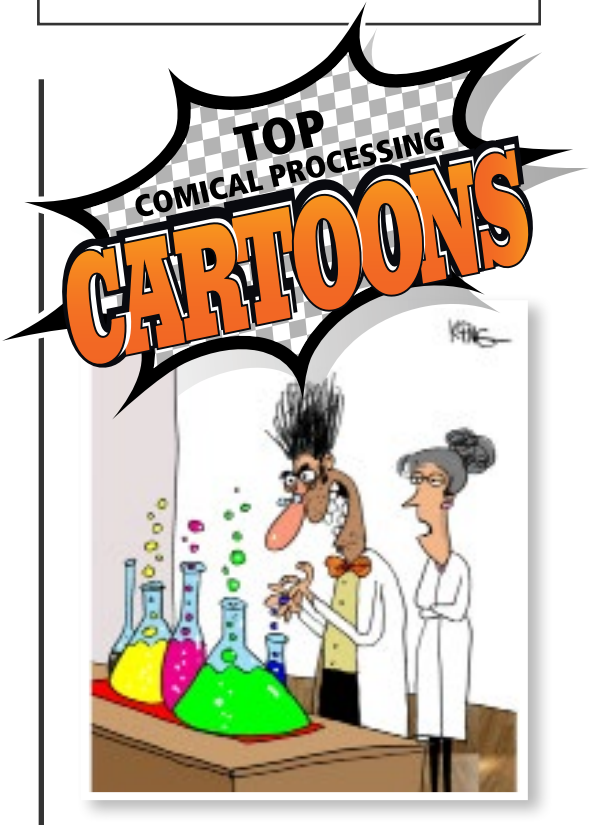

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