PLANT SERVICES®

DECEMBER 2025

TRUE TALES OF PdM

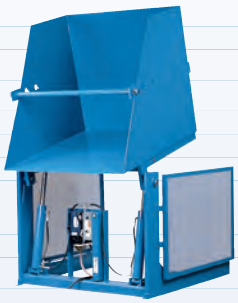
Crack open the book on our annual collection of predictive maintenance mini-case studies

ADVANCE LIFTS®

Production Solutions

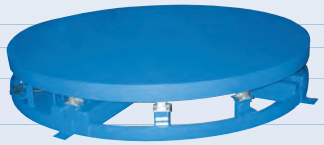
LIFT TABLES

250,000 Cycles Warranty
1,000,000 Cycles Warranty
3,000,000 Cycles Warranty
Position Control to +/-.030”



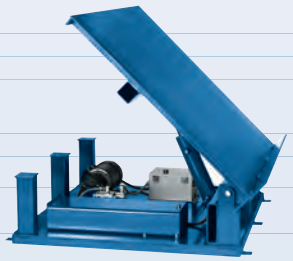
DUMPERS

Standard Duty
Heavy Duty
High Reach



TURN TABLES

Cam Follower Base
Caster Base
Ring Bearing Base
Manual Or Electric



TILT TABLES

Electric Hydraulic Operated
Air Operated
Bin Tilters

SEE MORE AT advancelifts.com

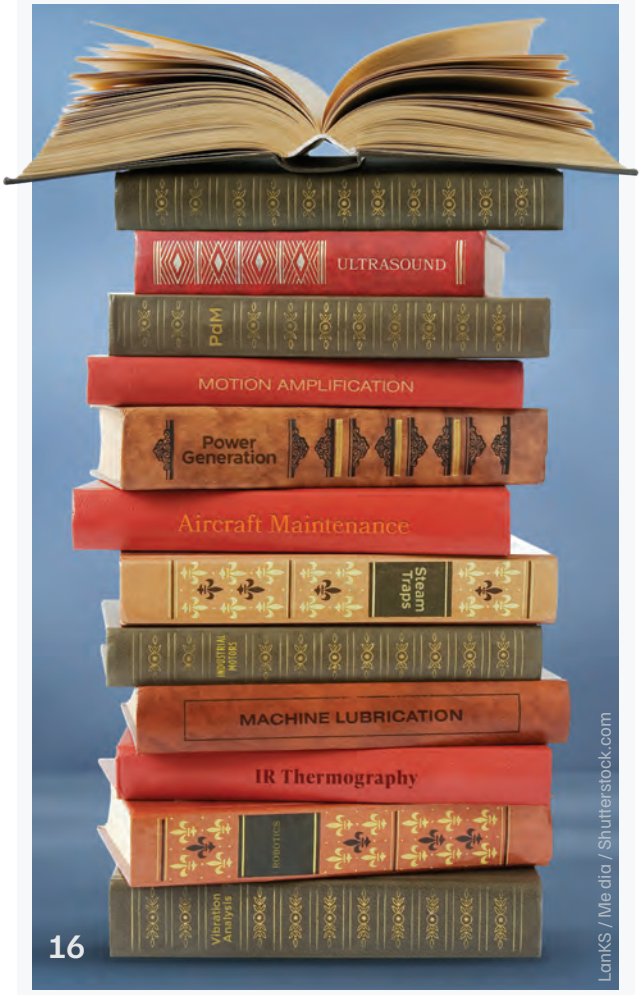
made in USA

ISO 9001:2015 Certified

50 YEARS Outstanding Service

1-800-843-3625

COVER STORY



True Tales of PdM Success

Including AI-driven condition monitoring, ultrasound tools, and motion amplification

FEATURE

Debunking 12 Common Lubrication Myths

Stick with these best-practice realities to turn your oil anal ysis program around

COLUMNS

AD INDEX

FACILITIES EXPO®

including MANAGING GREEN BUILDINGS®

WHERE FACILITY CHALLENGES FIND SOLUTIONS

CENTRAL VALLEY
March 18-19, 2026
Lodi, CA

SOUTHERN CALIFORNIA
April 8-9, 2026
Anaheim, CA

NORTHWEST
April 29-30, 2026
Portland, OR

facilitiesexpo.com

OWNED & PRODUCED BY:

ENDEAVORB2B™

ENDEAVOR BUSINESS MEDIA

Endeavor Business Media, LLC
30 Burton Hills Blvd, Ste. 185
Nashville, TN 37215
800-547-7377

Chris Ferrell
CEO

Patrick Rains
COO

Jacquie Niemiec
CDO

Tracy Kane
CALO

Amanda Landsaw
CMO

Lisa Paonessa
EVP Manufacturing & Engineering Group

Robert Schoenberger
VP of Content Strategy, Manufacturing & Engineering Group

Jason DeSarle
VP of Sales - Manufacturing and Processing Group

Jeff Mylin
Account Executive
jmylin@endeavorb2b.com

Dave Madonia
Account Executive
dmadonia@endeavorb2b.com

EDITORIAL STAFF

Thomas Wilk
Editor in Chief
twilk@endeavorb2b.com

Anna Townshend
Managing Editor
atownshend@endeavorb2b.com

Alexis Gajewski
Senior Content Strategist
agajewski@endeavorb2b.com

CONTRIBUTING EDITORS

Joe Anderson, CMRP, CRL, CARO
David Berger, P.ENG.
Sheila Kennedy, CMRP
Joe Kuhn, CMRP
Doc Palmer, P.E., MBA, CMRP
Jeff Shiver, CMRP, ARP, CPMM, CRL

PUBLICATION SERVICES

Meg Fuschetti
Art Director

Edward Bartlett
Production Manager

Melissa Meng
Ad Services Manager

Robin Darus
Sales Support Specialist
rdarus@endeavorb2b.com

Subscription Requests
Local: 847-559-7598
Toll free: 877-382-9187
PlantServices@omeda.com

THOMAS WILK
From the Editor

PdM CASE IN POINT

For this final Plant Services issue of the year, we bring you the latest in our annual series of predictive and proactive maintenance mini-case studies.

Every year since 2020 we have asked contrbuting editor Sheila Kennedy to collect the best examples of PdM successes in the field that she has heard over the past 12 months, and then share them with you. And this year's case studies (True Tales of PdM Success, p.16) represent a pretty great cross-section of industry, including biochem, aerospace, and defense, as well as food & beverage.

Two data points from those stories really grabbed my attention. The first was the $250,000+ savings identified by biochem manufacturer BioKyowa, when they combined ultrasound monitoring and analysis with condition-based lubrication to analyze and then optimize the performance of bearings, electrical systems, and steam traps.

The second was food & bev company Ingredion deploying real-time condition monitoring, including vibration sensors and AI-driven diagnostics, on both critical and hard-to reach assets. The Ingredion team reduced maintenance costs by close to $250,000 and realized $1M in production savings.

Those are impressive hard-dollar numbers. But the other thing that catches my attention across is how PdM technologies are enabling plants to run more efficiently in the face of the current labor crunch. Under fluid tariff conditions and long-standing skills gap crisis, many plant teams are looking for external partners to help them achieve predictive maintenance success.

For example, in an article on plantservices.com, Frank Mignano, condition monitoring sales manager at Schaeffler Group observes "there used to be three to five guys in a department; now it's one guy, maybe two, and they have no time for anything," Mignano says. "We're an extension of their reliability team, and they tap into our knowledge and experience."

In a separate case study, energy company TotalEnergies deployed an AI-driven operations assistant at their Port Arthur refinery outside of Houston specifically to help cover for an acute shortage of skilled oil and gas workers. They report that their PdM solution is successfully forecasting events on average 12 minutes before they happen.

I hope you take inspiration from these case studies, as well as practical direction as needed. After all, as the show Doctor Who put it years ago, "We're all stories in the end. Just make it a good one." Δ

Thomas Wilk, Editor in Chief
twilk@endeavorb2b.com, (630) 454-7012

JOE KUHN
Leadership in Action

OVER-RELIANCE ON TECH IS HURTING PLANT RELIABILITY

Balancing technology with human expertise can improve long-term manufacturing performance

Plant managers, maintenance managers, engineers, planners, and supervisors: I'm not here to sugarcoat this. Your operation is likely infected with a silent killer—hubris, an overconfidence in technology that dismisses decades of hard-earned wisdom.

This mindset is driving up costs, tanking reliability, and frustrating your teams. As an equipment reliability expert with more than 38 years as a practitioner and consultant, I've seen this before. It's not new, but it's worse in 2025, fueled by apps, sensors, and a dangerous gap between virtual data and shop floor reality.

Recognizing this contagion is step one. Fixing it? Good news—it's free, fast, and proven. The core issue is reliability teams worshiping technology as a godsend, replacing the gritty reality of experience, intense observation, and human collaboration.

It's not that tech is bad; far from it. Sensors, AI-driven analytics, and mobile apps are game-changers when used right. But when they become the sole source of information, they erode the foundations that have kept plants getting better every day for decades. I've walked into too many facilities where downtime is skyrocketing, maintenance costs are ballooning with low morale, all because leaders are managing from an electronic dashboard on a smartphone.

First, experience is not a dinosaur; excellence happens when it is partnered with tech. Newer professionals are often gifted and filled with enthusiasm and confidence; however, many are blind to decades of experience upon which the plant has excelled, failed, learned, and improved. That old-timer might not know the latest AI tools, but they know if PMs are completed with precision and if poor work practices are being accepted as good. They remember how past mistakes and process drift led to a week of downtime seven years ago.

Joe Kuhn, CMRP, former plant manager, engineer, and global reliability consultant, is now president of Lean Driven Reliability LLC. His YouTube Channel offers content on creating a reliability culture as well as financial independence to help you retire early. Contact Joe Kuhn at *joekuhn1964@gmail.com*.

Actions to begin Monday:

- **Implement mandatory mentorship programs where new hires shadow veterans for at least two days per quarter. Document the learnings to their supervisors, and make it part of performance expectations.**
- **Insist on cross-generational problem-solving teams for every major breakdown analysis. Listen to the war stories.**
- **Create a "lessons learned" database on equipment that blends oral histories from retirees with digital records.**

Second, technology like sensors with automated alerts has chained people to their phones and desks, replacing actual time on the shop floor. A vibration sensor pinging your app is handy, but it's worthless if you don't actually see the operator overloading the machine or the subtle leak that's been building for days. I've audited plants where "predictive maintenance" tools flagged issues, but no one bothered to walk the line and confirm root causes. Result? Real problems fester, and reliability tanks. There is no substitute for shop floor time. None.

Actions to begin Monday:

- **Begin "floor time mandates:" require engineers, technicians, and managers to spend at least four hours per week observing operations or maintenance activities. Use this time to note process anomalies, identify wastes, and to correlate reality with sensor data.**
- **In meetings, do not allow anyone to speak about a problem or potential solution without logging at least two hours of**

observation time on the shop floor on the specific problem. This will drive a culture change immediately. I loved this one at my plant: Simple. Free. Impactful. Better Decisions.

Third, tech has nuked face-to-face discussions, turning healthy conflict into Slack threads. Everyone's siloed behind screens, avoiding the debates that spark innovation. In my maintenance manager days, the best reliability improvements came from spirited discussions on the shop floor where mechanics, engineers, and supervisors challenged each other and added "go and see" to validate assumptions and opinions. Now? It's all emails, conference rooms, and dashboards, breeding misinformation, poor hypotheses, powerlessness, and indifference. Collaboration isn't optional; it must become a core competency.

Actions to begin on Monday:

- **Reinstate the morning "yesterday, today, tomorrow" stand-up meetings on the floor: Virtual meetings are not a substitute. Discuss what fell short of the standard yesterday, what help does anyone need to meet the standard today, and what help do you anticipate to need tomorrow to meet the standard. Standards can be: OEE, Quality, Safety, Outage Duration, or whatever is critical to your business. Norm: open disagreement with observational and technical data is not just encouraged but expected. This meeting should lead to group visits to the problem area(s).**

Fourth, poor performance is met with excuses instead of accountability. My son-in-law, a U.S. Marine, says, "Excuses don't win battles." Blaming "unforeseen" breakdowns is unacceptable. People and technology must collaborate to audit and anticipate problems. You must know how equipment and processes can fail and get in front of it. A good excuse only details why you lost. You still lost.

Actions to begin on Monday:

- **Excuses must be challenged with questions like: (a) Were there any early warning signs? (b) Does the PM eliminate this root cause? Why not? Have you observed the PM being executed? (c) When was the last time you observed the process that failed? (d) What tech can we apply to prevent reoccurrence? (e) Is production operating the equipment correctly? How do you know? Every time I have implemented this culture, the excuses fade.**
- **Reward those individuals and teams that are proactive through collaborative foresight. These are the real heroes in a reliability culture.**

Finally, procedural drift is the stealth assassin in plants. (Drift: the natural tendency for people to shortcut and deviate from a best practice over time. It is always present.) For example: for preventive maintenance, are you using the right grease, the exact amount, at the precise interval? Did all 22 steps get completed, or did the more difficult steps in the procedure get skipped for convenience or time pressure? I've audited hundreds of PMs where poor execution led to catastrophic failures. Fact: "drift" happens when audits lapse, and trust should erode without factory floor verification. Drift is not visible on a dashboard.

Actions to begin on Monday (and longer term):

- **For overall drift, roll out "Process Management." This is a system where a process owner is accountable for results, anticipating problems, process procedures, corrective actions, and weekly floor audits to spot drift. Begin with five pilot areas and five process managers to develop your overall system. A small plant may have 20-40 process managers after six months. Most would spend about two hours a week on this task.**
- **These process managers have an overall Process Management Manager that coaches, guides and audits the plant-wide system. Examples of processes: lubrication, pump rebuilds, shaft alignment, bearing installation, crane PM compliance.**
- **Leadership must conduct random PM audits weekly. Make it a system that is audited. Verify every step with checklists.**
- **Error proof actions based on mistakes commonly observed. Example: For lubrication, implement color-coded grease guns to prevent mix-ups and automated dispensers for exact amounts.**

This isn't theory—it's battle-tested reality. Assess your plant for these symptoms with your leadership team today. Lead by example: get on the floor, mentor your team, and audit a PM personally. Ignore this, and your plant will keep hemorrhaging money and talent. Δ

DOC PALMER
Palmer's Planning Corner

HOW "DO IT RIGHT THE FIRST TIME" CAN ALIGN WITH CONTINUOUS IMPROVEMENT

Work conditions are always changing, and doing the job right includes plant teams pointing out potential improvements

The oft heard "Do it right the first time!" clearly calls for quality, quality, quality! We must have a pushback for quality if we push for productivity. Absolutely! But how does that admonition square with Dr. Deming's insistence that we must strive for continual improvement, and that if we presume perfection, we lose? In reality, no contradiction exists, but industry misunderstanding frequently leads to missing the great opportunity Dr. Deming provides for our becoming industry leaders.

A global oil company's maintenance vision includes the statement "Deliver quality – Do it right, do it once." A poster in a steel mill declares "EFFICIENCY & QUALITY MEAN DOING THE JOB RIGHT THE FIRST TIME." A union bumper sticker exclaims "We Do It Right the First Time!" We have heard "If you don't have time to do it right, do you have time to do it over?" This type of sentiment has found its way into the maintenance planning process leading to some companies adopting "Procedures-Driven Maintenance" where planners strive to create first-time, near-perfect job plans, dictating mandated job steps for craftspersons to improve the quality of task execution.

On the other hand, Dr. W. Edwards Deming began in the 1950s preaching quality through constant improvement, by openly embracing the idea that we are not perfect. An American, Dr. Deming led post-WWII Japan to become a global industrial giant. Dr. Deming's work is considered the ultimate authority on quality, and nine of his famous "14 Points" directly point to admitting we are not perfect and allowing craftspersons to exercise their skill beyond any static procedure or job plan:

- **Point 1: "Create constancy of purpose for improvement..."**
- **Point 2: "Adopt the new philosophy." (This *new* philosophy deals with not accepting any status quo.)**
- **Point 5: "Improve constantly and forever..." (We now call this improvement the Deming Cycle.)**
- **Point 6: "Institute training."**
- **Point 8: "Drive out fear." (Blind obedience is not desirable.)**
- **Point 10: "Eliminate slogans, exhortations, and targets for the workforce." (Dr. Deming specifically deplores the exhortation "Do it right the first time." Deming asks how a maintenance person could make it right the first time when the incoming material is off-spec, the machine is not in good order, and the measuring tools are not trustworthy.)**
- **Point 11: "Eliminate numerical quotas..." (This point specifically addresses "work standards" that ignore the system the worker is under.)**
- **Point 12: "Remove barriers that rob people of pride of workmanship."**
- **Point 13: "Encourage education and self-improvement for everyone."**

Altogether, these points highlight that Dr. Deming wants to improve the system by everyone improving themselves to help show what can be improved. Management must establish this culture to move beyond the status quo to greatness.

Doc Palmer, PE, MBA, CMRP is the author of McGraw-Hill's Maintenance Planning and Scheduling Handbook and is managing partner of Richard Palmer and Associates. For more information including currently scheduled workshops, visit *www.palmerplanning.com* or email Doc at *docpalmer@palmerplanning.com*. Also visit and subscribe to ww.YouTube.com/@docpalmerplanning

However, we can carefully reconcile DIRTFT (Do It Right the First Time) and Dr. Deming. Like any prescription drug, DIRTFT can be helpful or harmful. In a harmful sense, DIRTFT is a frustrating, popular slogan that blames system problems on the individual worker.

In a helpful maintenance manner, DIRTFT should be where craftspersons *do the best job execution possible subject to constraints* of what is available. Craftspersons should never cut corners just to complete more work. At the same time, craftspersons should never blindly follow job plans. Trained and skilled craftspersons should apply their skill and experience, not simply follow step-by-step job plans that may not (or never) be perfect. Craftspersons must also speak up based on their skill and experience *to suggest improvements* to job plans "for the next time."

Likewise, DIRTFT should be where planners *do the best job plan possible subject to constraints* of what is available and the time they have to plan all the work. Proper planning is actually job triage, where planners give the best head start that they can in the time they have available, and then later update the plans with craft feedback. If planners had to be first-time (or anytime) "perfect" with each plan, they could never get all the work through the Deming Cycle.

Do It Right the First Time should mean everyone doing the best they can within the constraints that they have and then audibly voicing possible improvements to make things better. DIRTFT should be planners giving the best head starts they can subject to the constraints of time. DIRTFT should be craftspersons do the best execution they can subject to any constraints they have, where they freely exercise their skills, and where they give feedback for plan improvement. DIRTFT should be an admonition not to cut corners and to provide ideas for improvement. But because it can be misleading, we probably ought to change "Do it right the first time" to "Everyone should do the best they can considering what's going on and in the system they have to deal with while always making suggestions for improvement," but that's a mouthful. How about "Do what is right"?

Implement maintenance right the first time where trained and skilled persons at every position do the best they can and they always offer suggestions for improvement in everything, forever. Don't settle for good. Be great and greater and greater and greater... Δ

JEFF SHIVER

FROM FIREFIGHTING TO RELIABILITY

Technical skills alone aren't enough for maintenance leadership

In too many plants, "keeping it running" has become the badge of honor, rather than promoting a reliability mindset. When I walk into a plant, I'm likely to find one of two different scenarios.

In the first, the plant is in a reactive mode. The maintenance technicians are running from one crisis to the next, patching equipment just enough to limp through to the next shift. It seems there's never time to do the maintenance right the first time, but plenty of time to fix it when it breaks again.

In the other, similar types of assets run smoothly. The downtime is predictable, and maintenance activities are planned and scheduled. The team focuses on improvements. The difference isn't the equipment or even the budget.

Often, the difference is what I like to call the "reliability mindset."

WHAT IS RELIABILITY MINDSET?

As a plant manager or maintenance manager, you likely often discuss reliability. I prefer the military definition of reliability—the probability that a system, equipment, or component will perform its intended function under specific conditions for a defined period. When the ISO 55000 committee was defining the standard, one of the biggest challenges it faced was defining the term "asset." Assets include equipment, data, and people, too. And this is where mindset comes in—the people. Mindset is a collection of beliefs, attitudes, and assumptions that shape how we perceive the world and how we interact with it. If we allow a culture that constantly accepts failure, especially repetitive failures, then we'll always be in a reactive broke-fix state.

I define a "reliability mindset" as the combination of beliefs, attitudes, and disciplined behaviors that make achieving reliability possible. And it starts at the top.

A REAL TRAP ON THE PLANT FLOOR

I often work with maintenance organizations that are caught in the trap of "hero mode." The maintenance leadership is promoted into their positions because they're the best technicians on the floor. No one can troubleshoot a machine faster, and their technical skills make them invaluable (as technicians). They become the obvious choice for promotion.

And herein lies the trap: Rising through a reactive culture will keep you locked in the firefighting mindset. It's what you have come to accept for years. The same equipment problems haunt you month after month. The planners never have time to plan because they are constantly pulled into emergencies. You believe you're doing the right thing because you "keep it running."

Ultimately, what helped you get promoted as a maintenance leader won't keep you there or get you to the next level. It's a real struggle for maintenance managers and supervisors.

They're promoted based on technical skills, but rarely given the training, coaching, or strategic tools to lead a reliability-centered transformation. You'll often hear, "We don't have the people, we don't have the budget, and production won't give us downtime." Sound familiar?

Those are self-limiting beliefs that reliability isn't possible there.

My challenge is to get them thinking differently, changing their mindset. Pilot a preventive maintenance optimization on a critical line, beginning with planning and scheduling, or getting the operations group to report minor defects.

Jeff Shiver, CMRP, is a founder and managing principal at People and Processes, Inc. Jeff guides people to achieve success in maintenance and reliability practices using common sense approaches. Visit *www.PeopleandProcesses.com* or email *JShiver@PeopleandProcesses.com*.

STEPS TO ACHIEVE THE RELIABILITY MINDSET

Remember, mindset is what you believe and how you act. Here are some steps to begin:

- **Get educated.** You don't know what you don't know. If you haven't already done so, educate yourself and your team. Don't forget to include the plant manager and your production partners. Discover what's possible and paint a clear vision of the desired future state.
- **Challenge the self-limiting beliefs.** Listen for phrases like "Production will never give us equipment access" or "We don't have time to plan." Recognize these as barriers, not truths.
- **Redefine success.** While you must recognize the technicians who come into the plant in the middle of the night to fix down equipment, that's not the end game. Reward the people who prevent assets from failing in the first place. Create a culture that refuses to accept repetitive failures.
- **Start small.** Rome wasn't built in a day. Don't try to fix the entire plant overnight. Pick one! One line, one area, or one asset to prove that reliability is possible. Nearly all the reactive plants I visit lack a strategic roadmap for change. Where is yours?
- **Engage operators as partners, not customers.** Reliability isn't just a maintenance function. Operators are the first line of defense. Teach them to identify and report potential failure conditions early.
- **Build discipline around planning and scheduling.** Planned work is predictable, safer, and less expensive. Moving from 20% to 50% planned work can transform morale and the business results.
- **Develop your leadership skills.** If you were promoted for your technical skills, recognize that leading reliability requires a different set of tools: communication, coaching, influencing operations, and building a plan for cultural change.
- **Learn from every failure.** When something breaks, understand the "why." That should be the first question asked by leadership when failures occur. Then, take action to ensure that failure is not repeated.

Know that your true value as a leader isn't how fast you can fix equipment—it's how well you can prevent failures and build a team that believes reliability is possible.

The reliability mindset is about progress, not perfection: one planned job, one prevented failure, one shift in belief at a time. Δ

SPONSORED CONTENT

Industry Perspective

Matthew Dixon is Swagelok's Global Technical Lead for Grab Sampling. In this role he teaches Swagelok teams and customers about grab sampling and other applications, primarily within the oil, gas, and chemical industries. Contact Matt at www.linkedin.com/in/matt-dixon-applications-expert.

CAPTURING THE INVISIBLE

Explore best practices in gas grab sampling

Plant Services recently sat down with Matt Dixon, Swagelok's global technical lead for grab sampling, to talk about the complexities of gas grab sampling — a critical, yet often misunderstood process in industrial operations. Matt also worked for many years as part of Swagelok's Custom Solutions group, which takes the valves and fittings made by the company and builds them into bigger and better things, including things like grab sampling panels.

PS What would you say are some of the unique challenges of gas grab sampling compared to other kinds, like liquid sampling, especially when it comes to maintaining sample integrity?

MD Probably the first thing I would say is different about gas grab sampling is pressure—specifically because gas, being compressible, stores a lot of energy. Compare that to liquid, which is incompressible, and of course doesn't really have a lot of stored energy.

But because of that compression and that compressibility, we end up with another factor called time delay. That's where we pack a bunch of molecules into the line, and it takes a long time for the molecules to get from one end of the line to the other—because you can think of our sampling systems as having some sort of maximum flow capacity. Think of it in terms of some number of molecules per minute that we can process. And of course, if you have more molecules packed into the line, then it's going to take longer to move from one end of the tubing to the other, based on a certain flow rate.

Beyond that, we have to worry about condensation of the sample—the sample actually changing phase on us. Especially if we're sampling a hot gas, like maybe something out of a flare where, if it cools down, now we may condense. Because of that, we try to keep the gas hot, so we use trace lines, a heated enclosure to put our sampling system in, and even drop the pressure, which would help with that time delay problem we were talking about.

Another aspect is sample toxicity. If we've got a sample that is acutely toxic, we really have to be concerned about things like spillage from our quick-connects. All quick disconnects will have some sort of spillage when you uncouple them. Even ones marketed as "zero spillage" have some. Some are as little as a fraction of a milliliter; some could be more. But even if you've only got a fraction of a milliliter, if the sample is parts-per-million toxic, then that could definitely be a problem when we're talking about safety and gas sampling.

PS Let's talk about some of the environments themselves, especially demanding environments like liquefied natural gas facilities or refining facilities. What is it about the way that Swagelok approaches these facilities that makes them stand out in the field?

> **Online analyzers absolutely have their place, but grab sampling is certainly something that will always be around because of the economics of it.**

MD In a rugged industrial environment, in a sampling operation, your first consideration has to be safety. It's really the most important rule—we have to make sure the operator goes home at the end of the day in the same good condition they arrived in that morning.

A general rule of thumb I have is that if you're relying on the operator's PPE as the primary safety measure

for a sampling operation, then you really need to think about engineering safety into the design of the panel. Some of those things we talk about—documentation, simplification, standardization, and automation—that's when we would start to integrate those things.

We also want to make sure our sample is designed for analytical purity. So, making sure that we don't have those dead legs we talked about before. Making sure that if we've got a hose, that it's downstream of our sample container so that it doesn't contaminate the sample.

We also want the ability to customize our panels. If you come in with a standard solution and try to make it fit every application, it's just not going to work. There are unique circumstances in these facilities that require unique solutions, and our ability to come in and adjust—whether it's materials of construction, the overall design of the panel, different processing or testing, or different methods of construction—that's something we really specialize in here at Swagelok.

In fact, we've trained over 300 of our engineers around the globe to be able to do these sorts of grab sample systems, and to be able to build and design them at the local level as well. And then, of course, fabricate them at the local level so that no matter where our customers are in the world, we've got the flexibility to do that and bring those customers in for factory acceptance tests. They don't have to travel all the way to Swagelok in Cleveland, OH—they can do it right there at the local level.

PS I'd like to move from the physical world more to the digital. You mentioned before that automation is changing the face of grab sampling. How do you see grab sampling evolving with that and other technologies like digitalization and real-time analytics?

MD Online analyzers and the like—you know, those are really kind of the gold standard in terms of being able to control our process. They give us essentially a real-time result on the analysis of our process. And that's really important in some cases, especially where you have processes that are changing quickly and we need to get a fast analysis done so that we can adjust our process and keep it within the specification.

However, there is an economic aspect as well. Analyzers are not inexpensive instruments—especially when you consider all of the support structure that needs to go around them. Generally, an online analyzer needs to be installed inside some sort of shelter, and of course, that takes real estate within the facility that can't always be found right next to where you're taking your sample. So if you've got to extract your sample and the shelter is, say, 100 meters away, now you've got 100 meters of tubing transporting the sample out to the shelter and 100 meters returning it back to the process. There's the cost of the shelter itself, the cost of installing all that tubing, and the cost of the associated utilities.

So online analyzers absolutely have their place, but grab sampling is certainly something that will always be around because of the economics of it. If you don't need to get that answer right away, then a grab sampling operation is definitely going to be the more economical choice. It makes a lot more sense in those cases.

Beyond that, even where you have online analyzers, you're still going to have grab sampling. There's always going to be some sort of redundant sampling operation going on, as a backup and also as validation for those online analyzers. You might take a grab sample on some periodic basis—maybe weekly, maybe monthly—and then compare the result of that grab sampling analysis to the result the online analyzer is giving you. That way, you can validate that it's giving a true reading.

So grab sampling is not going anywhere. I think that even in cases where you've got analyzers, it's still going to play a major role. I would say, though, that as we find more and more analyzer applications, the role will diminish slightly—but overall, it's still going to be significant. Δ

In a rugged industrial environment, in a sampling operation, your first consideration has to be safety. It's really the most important rule—we have to make sure the operator goes home at the end of the day in the same good condition they arrived in that morning.

MODERNIZING HYDROPOWER GENERATION AT SALT RIVER PROJECT

Platform standardization across four dams reduced O&M costs by 30% and halved troubleshooting time

For more than 120 years, the Salt River Project (SRP) has delivered essential power and water services to customers and communities in central Arizona.

Today, the electric power and water utility company serves more than two million people in what has become one of the top population growth areas of the nation: the metropolitan Phoenix area. It generates electricity from traditional power generation sources as well as renewable resources, such as solar, geothermal, biomass, wind, and hydropower, to deliver on its mission to provide reliable, affordable, and sustainable energy and water services to the area.

To meet evolving demand, the utility continually invests in its energy infrastructure, and its hydroelectric fleet is no exception. SRP is expanding its mix of clean, renewable energy resources, exploring the use of pumped storage to increase hydroelectric generation, and deploying carefully planned hydropower improvements.

SRP recently standardized four dams along the Salt River on a fully integrated automation platform and modern control strategies, enabling greater operational visibility and control, improving production reliability and efficiency, and reducing operations and maintenance (O&M) costs by 30% and troubleshooting time by 50%.

Continued population growth and extreme temperatures over the years had electricity consumption surging in the power provider's service area. For example, as Phoenix experienced record-high August temperatures in 2025, SRP delivered a record-breaking amount of energy to its customers.

With increasing loads heightening the need to optimize generating resource availability and reinforce grid reliability, SRP decided to modernize the legacy generator excitation systems at four hydropower plants: its Roosevelt, Horse Mesa, Mormon Flat, and Stewart Mountain dams. Together, these dams generate 265 megawatts of hydropower – enough to power more than 60,000 average-sized homes annually.

Excitation systems are essential to hydropower generation as they provide regulated DC current to the field windings of the generator. Establishing consistent excitation systems and controls across the plants would increase reliability and performance, reduce costs, and create efficiencies in training, operations, maintenance, and the parts supply chain.

"As the long-time operator of the Bureau of Reclamation's dams, we have a responsibility to ensure delivery of a reliable, clean, and continuous source of power the community depends on," explains Shari Brady, hydro electrical engineer at Salt River Project.

To standardize excitation system automation and control, SRP chose the Ovation Automation Platform from Emerson, which is specifically designed to support smarter, more efficient, and scalable power and water industry operations. Modernizing its plant and excitation controls with this solution would help improve the reliability and efficiency of renewable energy production and increase energy security in the face of growing demand.

SRP has standardized on Emerson's Ovation™ Automation Platform for its hydropower fleet, modernizing plant and excitation controls—even at the nearly 120-year-old Roosevelt Dam—to help ensure a reliable, clean, and continuous supply of power for its customers.

Together, the companies embarked on a multi-year hydropower modernization project at the four dams. As part of the platform, SRP now has custom Ovation Excitation Systems seamlessly integrated into its existing Ovation distributed controls at the four dams. Two of the new excitation systems are for pump and energy storage units that require unique integration when switching to pump mode.

The unified, cohesive plant system improves the Arizona power provider's hydroelectric capabilities while also simplifying operations and maintenance. The same spare parts are used across the hydro fleet, training is streamlined, operators have a common user interface, and there is a single point of contact for automation service and support.

The new solution has SRP better equipped for the future with an improved ability to ensure operational continuity and strengthen grid performance. Quantified gains include:

- **O&M costs reduced by 30%**
- **Troubleshooting time cut by 50%**
- **Unit reliability maintained in the 90th percentile.**

Additionally, enhanced operational visibility helps to keep critical startup and shutdown procedures efficient, avoiding delays that could have doubled their duration.


Source: SRP

"By standardizing on Emerson's fully unified Ovation Automation Platform across our hydro fleet for excitation and plant control – and through close collaboration between project teams – we completed all system installations on time, even with aggressive schedules," says Brady. "We now have greater operational insight and easier troubleshooting, which helps us maintain unit reliability in the 90th percentile."

The hydropower modernization project delivered on its goal to enhance support for a reliable, clean, and continuous supply of power for SRP's customers, while also contributing to a secure water and clean energy future for the metropolitan Phoenix area.

"Increased visibility and reliability of hydro operations help Salt River Project ensure continuous operation to efficiently supply their customers with the power they rely on 24/7," says Bob Yeager, president of Emerson's power and water business.

Nick Kozack, director of North America services for Emerson's power and water solutions business, adds: "By standardizing on a unified Ovation automation platform, SRP has created a powerful foundation for digital transformation across its hydropower fleet. This architecture not only streamlines operations and simplifies lifecycle support but also opens the door to integrating our growing suite of AI-based tools for the Ovation platform, helping reduce unplanned downtime, extend asset life and lower total cost of ownership." Δ

TRUE TALES OF PdM SUCCESS

AI-driven condition monitoring, ultrasound tools, and motion amplification technology lead our annual collection of predictive maintenance mini-case studies

Written by
Sheila Kennedy
CMRP

LankS / Media / Shutterstock.com

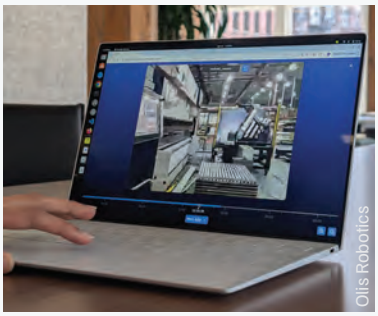
Maintenance optimization tools and methods are continually expanding and improving, yet there is no better time to leverage their potential than now. Below are six maintenance and reliability case studies demonstrating a resolve to solve existing problems, without fear of missing out on some future innovation.

1. REMOTE MONITORING AND TROUBLESHOOTING ON PROCESS AUTOMATION CELLS

Challenge: Mid Atlantic Machinery Automation is a robotic automation systems integrator and provider of solutions such as automated press brake tending. Whenever a customer experienced technical issues, on-site troubleshooting and correction was often needed. A more advanced solution was needed to minimize costly equipment downtime and reduce engineer travel time and expenses.

Solution: Mid Atlantic chose the Olis app, a plug-and-play solution from Olis Robotics that enables remote monitoring, diagnostics, error recovery, and control of robots from the app. Full setup took less than five minutes, including purchasing the Android app online, establishing an Ethernet connection to the controller, and configuring the IP addresses. In addition, engineers can set up alerts regarding irregular activity to predict hard stops and prevent them from occurring, and they can share screens for collaborative troubleshooting as needed.

Results: Adding remote monitoring, diagnostics, and control capabilities to Mid Atlantic's machines helped its service team to better manage the rapidly growing installed base. "Many times, we can fix a problem for our customers in mere minutes at no cost," says Josh Mayse, vice president and co-founder of Mid Atlantic Machinery



The Olis app allows remote service teams to troubleshoot customer robot cells faster and travel less.

Automation. "With the cameras, we see what is going on. We can restart their robots from our (tablet) in just a few clicks. Customers end up wasting less time and consumables because the problem is fixed immediately. Production can start up again much faster to maintain throughput."

2. REMOTE MONITORING AND CONTROL ON BACKUP POWER GENERATORS

Challenge: George Mason University serves tens of thousands of students as well as faculty and staff across its primary, 677-acre location in Fairfax, VA. An improved approach was needed to keep the campus buildings operational during power outages, reduce utility power downtime when it occurred, and increase efficiencies – especially with some Facilities Management team members living more than 30 miles away. Furthermore, ensuring the campus' 35 generators only ran when needed was necessary to control diesel fuel costs.

Solution: Partnering with Bay Diesel & Generator, the university chose the TrueGuard-PRO wireless remote condition monitoring and control system from OmniMetrix and its cloud-based monitoring software platform, OmniView.

Installing the monitoring units on the generators would provide visibility into accidental starts and stops, and of generators still running after utility power is restored. Utility power losses would generate instant text and email alarms notifications to Facilities Management, prompting them to quickly contact the energy provider, expediting outage response.

Results: The remote monitoring technology delivered ample response time and fuel cost savings. "Typically, per 100 kW of a generator's size, it will use 7.5 gallons of fuel every hour," says David Bratton, vice president Western Region at Bay Diesel. Preventing 35 generators of this size from accidentally running for one hour at full load, at a modest $2.50 per gallon, saves $656. Preventing them from running unnoticed over a weekend break brings the savings to more than $30,000. At the current average fuel price of $3.64 per gallon, the savings are significantly higher. The campus has 35 monitored generators currently and plans to install more.

3. INGREDIENTS PROVIDER USES CONDITION MONITORING AND AI ON CRITICAL EQUIPMENT

Challenge: The North Kansas City plant of Ingredion, a global food and beverage ingredients company, needed to keep its machines running around the clock but its traditional maintenance tools were not fully up to the job. Hard-to reach assets slowed inspections, and unnoticed early-stage issues on critical equipment, such as alignment problems or bearing wear, raised the risk of failures, unplanned downtime, and production losses. Easier, faster, and smarter maintenance technologies and processes were needed.

Solution: Ingredion decided to deploy a real-time condition monitoring solution from Tractian Technologies, including vibration sensors and AI-driven diagnostics, that was already delivering positive results at its South American facilities. Rolling the solution out to the North Kansas City plant would facilitate inspections there and help predict and prevent breakdowns by providing early warning of issues such as unbalance, looseness, or lubrication anomalies. Armed with alerts, predictive insights, and failure modes, the plant's maintenance and reliability team would be able to plan and schedule timely corrective actions and avoid full-blown failures.

Results: Tractian Condition Monitoring caught emerging failures on critical pumps and other Ingredion assets using AI-powered detection. At a single facility, it helped Ingredion realize:

- **$1.0M in production savings**
- **$223,000 in maintenance savings**
- **168 hours of avoided downtime across critical equipment through early warnings.**

4. AIR CARRIER USES INTEGRATED MRO SOLUTION FOR AIRCRAFT MAINTENANCE

Challenge: Aviation MRO activities are crucial to the performance and longevity of mission-critical assets. China Airlines, Taiwan's largest airline, had legacy mainframe systems that were mostly siloed and operated with various sets of processes, limiting access to critical data insights and MRO efficiency. Elevating the challenge were aggressive growth plans, an expanding fleet, and a worldwide manpower shortage. The confluence of factors highlighted the need for a digital transformation to minimize risk, maximize reliability, and optimize safety and compliance.

Solution: A thorough market search led China Airlines to select IFS for its system of record. Connecting the airline's systems and data into one integrated solution for maintenance program management, configuration and engineering, planning, materials management, and line, heavy, and shop maintenance would enable the airline to find and solve problems before they impact operations. Improved operational visibility, MRO process optimization, access to critical data from the field, and a just-in-time supply model would drive labor and cost efficiencies and ensure safer, more reliable passenger and cargo service.

Results: China Airlines gained numerous benefits from the integrated solution:

- **65 percent reduction of multi crew job card waiting time in heavy maintenance**
- **10 percent increase in line management process efficiencies**
- **10 percent increase in heavy maintenance manpower efficiencies**
- **3 percent increase in "A check" (lighter inspection) delivery efficiencies**
- **Average addition of 30 revenue days per year through a reduction in scheduled aircraft maintenance**
- **Average addition of 25 revenue days per year through a reduction in unscheduled aircraft maintenance**

5. MOTION AMPLIFICATION ON POWER GENERATORS

Challenge: Tactical generators that power Army weapon systems in all environmental and threat conditions must meet exact standards for power quality. During initial testing of 15 kW/400 Hz generators at a U.S. Army Depot in Pennsylvania, incidences of stator weld fractures leading to catastrophic generator failure occurred. When structural resonance was identified as a cause of the fractures, the Integrated Fires Mission Command (IFMC) proactively developed a stiffening and damping kit to mitigate the issue. However, IFMC needed a reliable means to verify the repeatability of the kit installation and validate its effectiveness in real-world conditions.

Solution: A service technician was dispatched from Cintel Inc., a provider of technical services supporting multiple Defense programs, to detect and analyze latent defects in the generators using the Iris M system and Motion Amplification (MA) software from RDI Technologies. This technology allows users to see and measure motion that is invisible to the human eye, enabling the technician to establish a standard operating baseline for each generator, analyze vibration data from the production assets, compare modified and unmodified generators, and develop a repeatable testing procedure for all production assets.

Results: With the MA-established baseline, Cintel was able to detect, quantify, and qualify a rotor-hub separation problem causing ground fault and catastrophic failure – a finding

15 kW/400 HZ trailer-mounted Army tactical generator.

that was instrumental in improving new inspection procedures and safety components and a production process. Cintel also detected, quantified, and qualified an early-stage mechanical looseness problem causing excessive vibration in some generators, leading to new torque procedures across the fleet. Ultimately, the MA data and analysis not only confirmed the kit's effectiveness in reducing resonance, but it also supports ongoing efforts to ensure the generators provide stable electrical power to crucial weapon systems.

6. BIOCHEMICAL PRODUCER USES ULTRASOUND TECH ON AIR LEAKS AND STEAM TRAPS

Challenge: Biochemical manufacturer BioKyowa produces high-quality amino acids used in products such as nutritional food supplements, cosmetics, and precursors for pharmaceuticals. Its technicians sought to be more efficient at performing air leak and steam trap surveys and lubrication routes across the Missouri facility.

Solution: Their search for new tools led to ultrasound technology, including the Ultraprobe 15,000, Ultraprobe 401 Grease Caddy, and complementary software from UE Systems. The Ultraprobe 15,000 would allow the technicians to analyze and diagnose everything from bearings and electrical systems to steam traps and leaks, enabling timely predictive actions before failure. The Grease Caddy would improve lubrication precision with real-time evaluation of friction in bearings.

Results: With condition-based lubrication, BioKyowa's technicians observed significantly extended lifespans for their bearings and reduced the frequency of grease application. With ultrasound monitoring and analysis, they discovered an annual loss of $175,901 from failed steam traps as well as an $86,000 loss from air leaks, and the resultant predictive maintenance saved them more than $261,000 annually. In just a few months, the savings covered the entire cost of the devices.

The manufacturer remains committed to using advanced technologies such as ultrasound as part of their comprehensive reliability program. Δ

Sheila Kennedy, CMRP, is a professional freelance writer specializing in industrial and technical topics, She can be reached at *sheila@addcomm.com* or *www.linkedin.com/in/kennedysheila.*

DEBUNKING 12 COMMON LUBRICATION MYTHS WITH BEST-PRACTICE REALITIES

Written by

Michael Holloway
President, 5th Order Industry

In industrial lubrication engineering, several common fallacies can lead to improper practices, increased wear, and ultimately equipment failure. Addressing these fallacies in lubrication engineering is essential for extending equipment life and reducing unplanned downtime.

1. "MORE LUBRICATION IS ALWAYS BETTER"

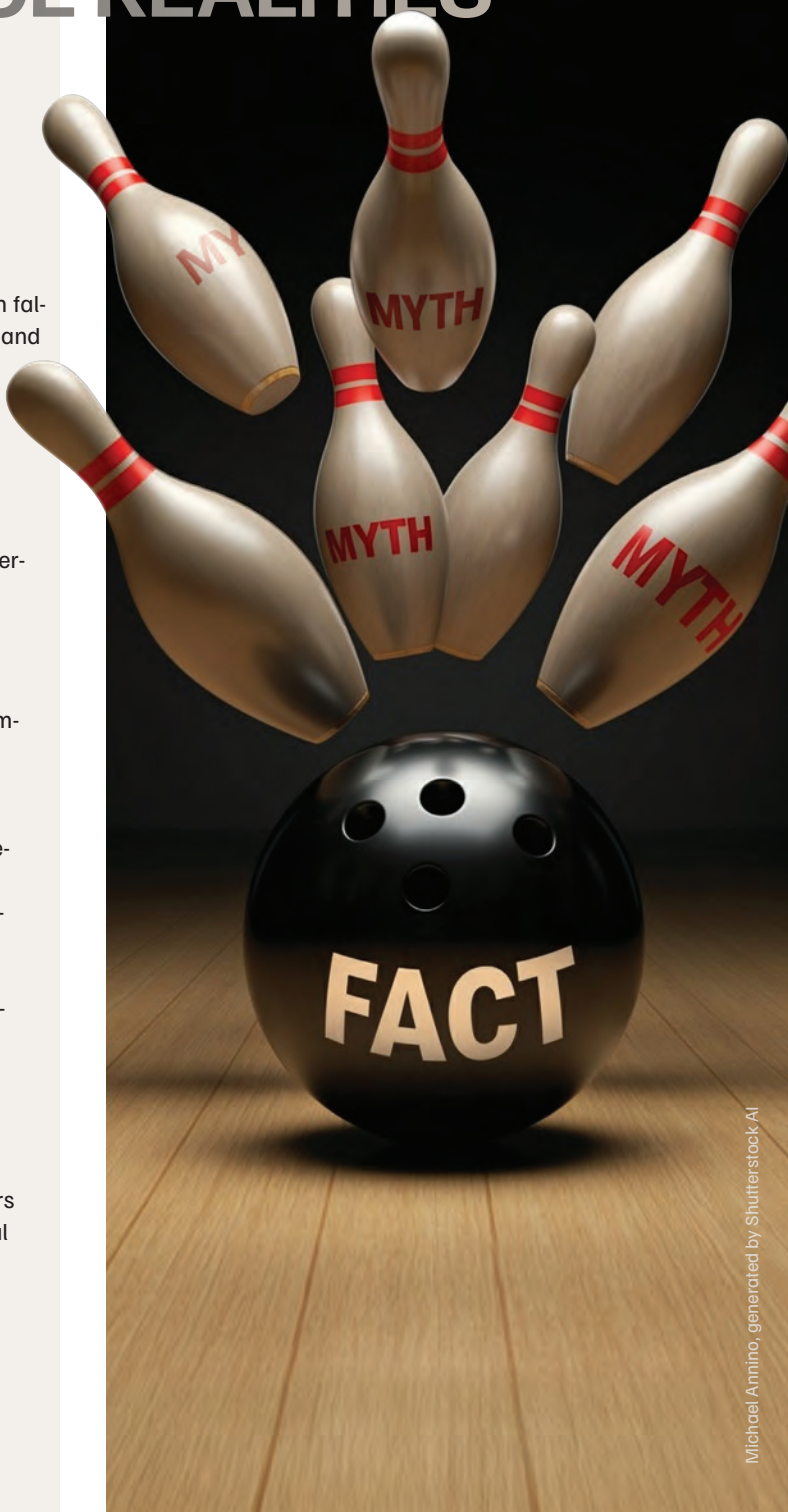
- **Fallacy:** Adding more lubricant will ensure better performance and reduce wear.
- **Reality:** Over-lubrication can cause issues such as overheating, seal damage, and increased energy consumption due to higher friction. For example, in bearings, excessive grease can lead to elevated temperatures and premature failure.

2. "ANY OIL WILL DO"

- **Fallacy:** As long as a machine is lubricated, the specific type or grade of oil doesn't matter.
- **Reality:** Different equipment requires specific lubricant properties to operate efficiently. For instance, hydraulic systems require oils with anti-foaming additives, while gearboxes need oils with high load-carrying capacity.

3. "LUBRICATION LASTS INDEFINITELY"

- **Fallacy:** Once lubricated, equipment doesn't need additional lubrication for a long time.
- **Reality:** Lubricants degrade over time due to factors like heat, oxidation, contamination, and mechanical stress. Regular re-lubrication and oil analysis are essential to monitor the lubricant's condition and ensure optimal equipment performance.



Michael Annino, generated by Shutterstock AI

4. "GREASES ARE THE SAME"

- **Fallacy:** Grease is grease, and any type will work for any application.
- **Reality:** Greases vary widely in properties, such as viscosity, dropping point, and additives. For example, high-temperature applications require greases with high thermal stability, while low-speed applications may need greases with high load-carrying properties.

5. "MIXING LUBRICANTS IS HARMLESS"

- **Fallacy:** Mixing different lubricants or greases will have no negative impact, either on the lubricants or on machine health.
- **Reality:** Mixing incompatible lubricants can cause chemical reactions that alter the lubricant's properties, such as viscosity, corrosion protection, and stability.

6. "SYNTHETIC LUBRICANTS ARE ALWAYS BETTER"

- **Fallacy:** Synthetic oils and greases are universally superior and suitable for all applications.
- **Reality:** Choosing lubricants should be based on the specific operational needs of the machine. While synthetic lubricants offer excellent performance under extreme conditions, they may not be necessary or cost-effective for all applications. In some cases, mineral oils can be sufficient and more economical for less demanding environments.

7. "ONCE A LUBRICATION SCHEDULE IS SET, IT DOESN'T NEED ADJUSTMENT"

- **Fallacy:** A fixed lubrication schedule established initially will remain effective indefinitely.
- **Reality:** Lubrication needs can change over time due to factors such as wear, environmental changes, or shifts in operating conditions. Regular analysis of lubrication schedules and adapting to real-world conditions are essential to maintain effective lubrication.

8. "LUBRICANTS DON'T NEED CONTAMINATION CONTROL"

- **Fallacy:** Lubricants are self-cleaning, and contamination isn't a major concern.
- **Reality:** Contaminants such as dirt, water, and metal particles can cause significant wear and reduce lubricant effectiveness. For example, a small amount of dirt can lead to abrasive wear in bearings. Proper filtration, storage, and contamination control practices are critical for maintaining lubricant quality.

9. "THICKER OIL PROVIDES BETTER PROTECTION"

- **Fallacy:** Using thicker oil means better protection and durability.
- **Reality:** Choosing the correct viscosity grade for the operating temperature and load conditions is essential, as oil viscosity must match the specific operating conditions of the equipment. Too thick an oil can increase friction, reduce efficiency, and hinder proper oil flow in tight spaces, particularly at low temperatures.

10. "COLOR IS A RELIABLE INDICATOR OF OIL CONDITION"

- **Fallacy:** The color of oil indicates its condition and remaining life.
- **Reality:** Oil color change is not always an accurate indicator of its condition or contamination level. Darkening may occur due to oxidation or additive depletion but does not necessarily mean the oil is unusable. Regular oil analysis, including tests for viscosity, acidity, and contaminants, provides a more accurate assessment of oil condition.

11. "NEW OIL IS CLEAN OIL"

- **Fallacy:** Freshly purchased oil is always free of contaminants.
- **Reality:** New oil can contain particles or contaminants introduced during production, packaging, or handling. Filtering new oil before adding it to equipment is a best practice to ensure clean lubrication and reduce the risk of introducing contaminants.

12. "ONE-TIME LUBRICANT SELECTION IS SUFFICIENT FOR EQUIPMENT'S LIFE"

- **Fallacy:** Once a lubricant is selected for a machine, it will remain the best choice for its entire operational life.
- **Reality:** Changes in machine operating conditions, updates in lubricant formulations, or advancements in lubrication technology may call for revisiting and updating lubricant choices periodically. Δ

Michael D. Holloway is President of 5th Order Industry and has 40 years' experience in industry. He is a subject matter expert in Tribology, oil and failure analysis, reliability engineering, and designed experiments for science and engineering.

THE CAPTAIN

Captain Unreliability

THE TRIUMPH OF "GOOD ENOUGH" ENGINEERING

Ah, plant equipment—the shining testament to the marvels of modern engineering! Or, more accurately, modern project management. Gone are the days when engineers pored over blueprints, meticulously crafting machinery designed to last.

Today, we've adopted a far more innovative approach: prioritizing timelines and budgets above all else, because who really cares if it actually works? And the results are exactly what you'd expect—an astonishing display of breakdowns, downtime, and maintenance costs that are a sight to behold.

Let's talk about the equipment engineering process. Well, I say "engineering" loosely, because true engineering takes time, attention to detail, and a deep understanding of function, durability, and reliability. But those things are so last century. Today's equipment "engineers" have embraced the ethos of the modern corporate world: fast, cheap, and good enough. Sure, the equipment might rattle, shake, or emit alarming noises, but as long as it meets the production schedule and stays under budget, it's a job well done!

You see, the real heroes in this saga are the project managers. They're the ones who've mastered the fine art of cost-cutting and timeline trimming, boldly asking questions like, "Does this really need premium materials?" and "Why design for 20 years of use when 5 will do?" Why spend a few extra dollars on quality components when you can throw in some budget parts and call it a day? After all, those poor maintenance folks always seem to find a way to fix things later. It's practically job security for them!

And nothing screams "innovation" quite like the way these project management wizards hit their targets. Yes, it's true that the equipment requires constant patch-ups, but look at the upside: that's more work for the maintenance department! Thanks to their efforts, repair crews get to stay busier than ever. Who wouldn't want to watch a team of skilled technicians crawling around inside a machine that breaks down every Tuesday like clockwork? It's a beautiful display of inter-departmental synergy: project management cuts costs up front, and maintenance gets to absorb them on the back end. Win-win!

Let's be honest: the only real engineering feat here is the art of cutting corners. Forget load-bearing capacity, or thermal tolerance, or lifespan. In today's fast-paced world, those things just slow you down! And if something does go wrong, there's always a ready explanation: "We followed standard procedures," or, my personal favorite, "That's not our responsibility now." As long as everything looks great on paper, the equipment's actual functionality is someone else's problem.

Modern plant equipment is often delivered with a lengthy manual full of "workarounds" and "temporary fixes." Need a component that doesn't overheat every time you switch it on? Just reduce the load to 80%. Need a valve that won't seize up? Well, that's what lubricant is for.

Now, let's not forget the ultimate measure of success: metrics. Project management's favorite tool! Who cares if the equipment only works for five minutes at a time, so long as the project report is filled with checkmarks and green boxes? "Look, we're on track! The equipment was delivered two days early!" And if the plant loses thousands of dollars in production due to downtime? Well, that's a different spreadsheet altogether. As far as the project team is concerned, they delivered exactly what was asked for: something that fits the budget and meets the timeline.

In the end, modern plant equipment serves as a tribute to the true priorities of today's manufacturing landscape: deadlines, budget constraints, and the thrill of mediocrity. Quality is negotiable, reliability is a luxury, and durability is an afterthought. And for those poor maintenance teams left to pick up the pieces? Well, let's just say that when you cut corners on equipment, there's always someone else left holding the broom. Δ

Captain Unreliability is a satire of the state of manufacturing in 'Merica, USA, by an industry professional known for using humor to get the point across. Email him at *Captain.Unreliability@ReliabilityX.com*, or follow him on Twitter: @CUnreliability.

30TH ANNUAL
ARC INDUSTRY LEADERSHIP FORUM

How AI Is Driving the Future of Industrial Operations and Supply Chain

FEBRUARY 9-12, 2026 • ORLANDO, FLORIDA

Join us at the 30th Annual ARC Industry Leadership Forum, where industry leaders and innovators come together to discuss the transformative power of AI in various sectors. This year's forum kicks off with a keynote and executive panel discussion on the latest trends and applications of Industrial AI. What's real and what's hype? What have leaders struggled with? Don't miss this opportunity to network with industry experts, gain valuable insights, and stay ahead of the curve in the rapidly evolving world of Industrial AI. Join us to learn more about:

- Smart Manufacturing & Digital Transformation
- Robotics
- Industrial Data Fabrics
- AI and Supply Chain
- Data Centers, AI, and Energy
- AI and Digital Twins
- Digital Connected Workers and AI
- Asset Performance and AI
- AI and Sustainability
- AI in MES and Operations
- Cybersecurity and AI
- Autonomous Operations
- Operational Performance & Resilience

Are you ready to explore the cutting-edge advancements in Industrial AI?

Go to www.arcweb.com/events/arc-industry-leadership-forum-orlando/ or call 781-471-1000

Visit digitaltransformationcouncil.com for more on ARC's Digital Transformation Council

Co-Sponsored by *Plant Services*

ARC Advisory Group

VISION, EXPERIENCE, ANSWERS FOR INDUSTRY, ENERGY, & INFRASTRUCTURE

Partners. The Best **Part** of All.®

MiMOTION®
Motion.com