Dan Spohn

From: ARM, Inc. <dspohn@arminc.com>
Sent: Saturday, October 21, 2017 2:18 PM
To: dspohn@arminc.com
Subject: Why does a sloth smile?

Advanced Research Manufacturing 719-538-5959
Innovative High Purity Gas Supply System Solutions

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Dear Dan,

This is a quick follow up to the September newsletter, and its focused on ARM's Tech Refresh service. Still, couldn't help myself.....

October 20th is International Sloth Day! Who knew? (apparently the AIUNAU) According to the information on https://www.daysoftheyear.com/days/international-sloth-day/ "there are several ways you could celebrate International Sloth Day". Learning to slow down and enjoy the little things of life is one suggestion. Another is to give up your daily cappuccino and donate the money you save to the AIUNAU!

Another suggestion was to just stop rushing around and relax, take your time at whatever you're doing. I experimented this morning on the way to work (during 'rush' hour). The speed limit through Colorado Springs on I-25 is 65 mph. I set my goal to keeping it between 60 and 65, signaled and moved into the sloth lane. Wow, so many people are in such a hurry to get to work, (or maybe its to get to Dunkin before the Pumpkin ones are sold out). I sipped my coffee and was amazed at how much I could notice on the drive in when I wasn't bobbing and weaving my way to work. Maybe there is a reason why sloths always look like they are smiling....could be they are in 'cruise control' at 60 mph in an 80 mph world.

(Alfred E. Neuman, eat your heart out)

But that's not what I want to talk about.....The installed base of bulk gas purifiers using heated getter, catalyst and adsorber technologies has been been growing since first introduced well over 30 years ago.

Today's bulk purifiers with modern controls and instrumentation are very close to an 'install it and forget it' design, yet millions of cubic meters of process gases are being purified by technology that is 10-20 years old. This long product life on the surface may appear to benefit the bottom line, in reality tho it may well represent a huge risk that really needs mitigation.

In this issue.....

Threats and Vulnerabilities of Aging Assets

Part of any effective asset management system is risk assessment and mitigation. In essence it is to first determine what incidents could occur detrimental to the asset and ultimately the ability to ship product or provide service, then determine what could be done to avoid such incidents.

Every asset implemented in the process of producing your product or service is subject to threats and vulnerabilities. Threats are relatively easy to understand and the action to mitigate risk from threats is fairly intuitive. Vulnerabilities on the other hand are sometimes easier to just ignore than they are to mitigate.

Threats are typically an incident that causes immediate loss of the asset.....

For a bulk purifier, a number of threats come to mind, and as noted mitigation is intuitive. These threats can include...

1) Loss of power - install backup source of power (generator)
2) Loss of air - install backup source of air (second compressor)
3) Component failure - scheduled testing/maintenance, inventoried spares
4) Operator error - scheduled training and retraining

Vulnerabilities on the other hand are not so easy to identify or mitigate. To be vulnerable is to be susceptible to harm. In the case of a purifier, susceptible to failure to provide pure gas at rated flows and pressures. One might argue that any asset is vulnerable to threats and I

would probably agree. There are asset vulnerabilities that are not immediate threats. These can include....

1) Slow increase of impurities in the inlet gas - reduced purifier lifetime, increased regen frequency
2) Performance degradation of temperature, flow, pressure sensors with age - non-optimum operation, increasing cost per cubic foot
3) Component obsolescence - spare components no longer available
4) Aging components - increased risk of complete failure

Some vulnerabilities are within the asset owner's control to mitigate. Certainly implementing a routine analysis of inlet gas purity, and adding a purifier's instrumentation to the facility's calibration/recalibration program can be done and solely at the asset owner's discretion. Aging components and component obsolescence on the other hand, are not typically within the asset owner's ability to mitigate.

Bulk purifier manufacturers are typically expert in the materials they implement for gas purification, but all rely on other OEMs for many of the components used in their purifiers. These include pressure transducers, mass flow meters, power distribution components, (ckt breakers, SSRs etc), high purity valves and fittings, PLCs, HMIs, pneumatic solenoids etc. Even if we assume the purifier manufacturer used the latest versions, with time these components are vulnerable to be discontinued, and/or obsoleted without support. Risk mitigation would be to purchase spares early the purifier lifetime, or make end of life buys of spare and replacement parts assuming you are informed of a pending end of life of a component. With the product life-cycle of electrical/electronic component getting shorter with each new technology developed, the vulnerability from component obsolescence increases.

So how long do you rely on an asset, on a bulk gas purifier? 5 years, 10 years, 20 years? There is anecdotal evidence of purifiers lasting 25 years and longer. But at what risk? At what cost?

Thinking of my commuter car, its 5 years old, and serviced routinely to mitigate threats from breakdowns. But my truck is 18 years old, and regardless of routine servicing has suffered numerous repairs over the years to replace aging and wearing components, fortunately all still available. I sometimes think before I hop in '*hope it starts*' and when I get home '*hope the tranny holds out another year*'. Its getting more expensive to maintain and more vulnerable to an end of life failure (cost of repair exceeding value of the asset). If I could sever emotional ties to the memories in it, I would realize it is probably past its '*use by*' date.

If your purifier asset has more than 10 years in service, it may be time to do an in-depth assessment of the threats and vulnerabilities, and make a decision to reduce the risk it may represent.

Crossing Over - MTBF to MTTF

MTBF (Mean Time Between Failures) is a predicted interval of time between failures of a repairable system. MTTF (Mean Time To Failure) is similar to MTBF but is applied to non-repairable systems and predicts what is essentially the end of service life of an asset.

Both MTBF and MTTF rely on in-depth analysis of components of a systems, and the environment in which those components are used. There are a number of documented methods and standards to calculate MTBF and MTTF (MIL-HDBK-217F, Telcordia SR332, Siemens Norm, FIDES,UTE 80-810) what is important is that different components of a system can have much different MTBF, MTTF numbers.

MTBF of a bulk purifier system can be no longer than the MTBF of the weakest components used. Cabinetry, support structures, stainless steel process piping/fittings, are all extremely durable and about the only failure to worry about is being run into by a forklift driver. Electrical and electronic components on the other hand can exhibit degradation in performance with age. Aging of electrical/electronic components can be accelerated by extremes in temperature and humidity that can be experienced on a gas pad in say Phoenix or Minneapolis.

As existing purifier designs age, the ability to provide replacement parts and at times even technical support diminishes to the point the manufacturer is left with no alternative but to discontinue all support. End of life. This is the point where the concern transitions from MTBF on a repairable asset to MTTF on an unrepairable asset. The failure moves from the vulnerability of 'if', to the threat of 'when'.

So while it might look good that an asset is still producing far beyond the original anticipated lifetime, it represents a risk that may not equal the reward.

ARM's Tech Refresh Service

A bulk gas purifier is comprised of many durable, long lived hardware components and many other electrical/electronic components that are susceptible to aging failure and premature obsolescence from the competitive nature of the high tech world.

When moving from an MTBF situation to an MTTF situation risk increases. The cost of lost production during the time it would take to acquire a replacement for a failed asset, when added to the new asset cost can be huge.

ARM understands that the MTBF or MTTF of a 1/2" stainless steel high purity isolation valve is an order of magnitude longer than the MTBF or MTTF of say a PLC card or pneumatic solenoid valve.

Depending on the gas being purified and the impurities removed, the durable components can represent 40% to 60% of the cost of a new purifier. Because the durable components have such a long life, there is cost savings to be realized by 'refreshing' the electrical/electronic components of an existing asset, as compared to replacing the entire asset.

ARM's Tech Refresh service does just that. We have two units being 'tech refreshed' on the production floor at this time. One is a SAES PS8-MGT200-R-2 Rare Gas Purifier, manufactured in 2001. The other is a Nippon Sanso Pegasus N-50E Nitrogen gas purifier, manufactured in 1998.

Typical of an ARM Tech Refresh, these two units were surveyed by ARM engineers to assess the condition and list the components recommended to be replaced. In both cases, the frame and sheet metal will be reused, although repainted or touched up to eliminate potential for rust. The electrical controls (relays etc) will be replaced. Heaters were evaluated and determined to be usable. Instrumentation including pressure transducer are sent out for recalibration. The PLC/HMI and associated electronics of both will be replaced with ARM standards. The software to control both purifiers will be ARM's Advantage Series standard. The units will be thoroughly tested in exactly the same manner and degree as a new ARM Advantage Series purifier.

Upon completion, the customer will have an asset that operationally will provide the same service life as a new purifier for a fraction of the cost.

To learn more see our web page or download the brochure. Or drop us an e-mail and we will contact you for further information. And as always we would be happy to provide a quote.

Thanks for reading this far!

We understand that there is very little time in the day to read all the newsletters that make it to your inbox. We will strive to not be 'that company' spamming the world with useless information seemingly every other day for no better reason than some webinar told them that is what they should do.

As noted above if you opt out we will honor your request. If you do tho, you may want to like us on Facebook or follow us on Linkedin so you can keep your inbox clear, but still keep in touch with what is going on with ARM Inc. in the gas world.

Sincerely,

Dan Spohn
ARM, Inc.