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Embracing a New Approach to Retroactive PMI

By Brian Wilson, Business Development Manager, Energy Markets at Thermo Fisher Scientific. This article appears in the July/August 2016 issue of Inspectioneering Journal.

Introduction

In such industries and applications as oil and gas, crude oil refining, petrochemical processing and power generation, the potential for construction material mix-ups is very real, and the need for traceability through objective quality evidence (OQE) has never been greater than it is today. Fortunately, the instrumentation available to detect inadvertent material substitutions through positive material identification (PMI) has never been more available, portable or powerful than it is today.

OQE is a term used in the US Navy's Nuclear Submarine Safety Program (SUBSAFE) and can be defined as *"a statement of fact, either quantitative or qualitative, pertaining to the quality of a product or service based on observations, measurements, or tests that can be verified."* In the nuclear Navy, one learns quickly that there is a procedure for everything, and there is no time like the present to perform a verification: if you don't have time to do it right the first time, when are you going to have time to do it again?

These principles can likewise be applied to retroactive PMI. Safety is paramount, and the assurance through objective quality evidence that correct materials get installed in the proper location, or verifying that existing materials meet intended requirements, is critical to reducing risk, protecting your brand name, and most importantly, protecting lives.

For one industrial services company, Tacten Industrial, Inc., embracing the latest technological advances in PMI while using rope access to conduct inspections has helped to transform their business. It has found the ideal formula for retroactive PMI that allows its team and its clients to rest assured that they've conducted their testing right – the first time.

Retroactive PMI using X-ray Fluorescence (XRF) Technology

X-ray fluorescence (XRF) analyzers are an important tool in any industry that relies upon PMI and elemental chemistry. And the nature of handheld analyzers makes them ideal for retroactive PMI.

Figure 1. New handheld technology offers speed, accuracy, and productivity to PMI inspectors. (Photo courtesy Thermo Fisher Scientific)

Using handheld XRF spectroscopy technology, nondestructive PMI testing of piping and components can be done in place without sending materials to an off-site lab or shutting down process equipment. Analyzers can verify the composition of metals and deliver lab-quality results in seconds. Recent advancements in handheld XRF analyzer technology allow for more effective and practical methods to measure and collect data for application specific corrosion mechanisms, such as low-silicon content. With traditional laboratory testing not needed, production delays can be avoided, safety compliance achieved, and customer expectations met.

XRF spectroscopy analyzes the composition of a sample by measuring the spectrum of the fluorescent x-rays emitted by the different elements in a sample when it is bombarded with high-energy x-rays. The fluorescent x-rays are measured by the detector, which can both

identify and quantify the element.

Establishing a written material verification program (MVP) defining the extent and type of PMI testing to be conducted can identify inadvertent material substitutions in critical process systems that could lead to process leaks to the atmosphere, equipment failures, unplanned shutdowns, or much worse.

American Petroleum Institute Recommended Practice 578 (API RP 578) provides the guidelines that should be followed when establishing a PMI or material verification program. PMI testing can provide complete records of material chemistry and prove to authorities that reasonable quality procedures have been put in place that mitigate risk.

Rope Access and PMI

Mitigating risk – along with accurate material identification and cost reduction, among other benefits – is in part why Tacten adopted XRF technology. They regularly test the structural integrity of energy, industrial and public infrastructures, conduct inspections across North America, and have overseen several major retroactive PMI surveys in the oil and gas and refining industries in recent years. Grant Lamb, project manager for Tacten in Western Canada, has found that rope access inspection using XRF handheld analyzers is the most efficient process for retroactive PMI. Industrial rope access is used to perform industrial tasks from inspection, to welding, to coating and many other procedures.

“Completing large scale retroactive PMI inspection scopes is a task best, and perhaps only, possible with a combination of an experienced rope access inspection crew and innovative XRF instruments,” Lamb said. “Trying to complete these extensive scopes by way of conventional access methods such as scaffolding, fall arrest, or man lift, among others, is a logistical and expensive nightmare.”

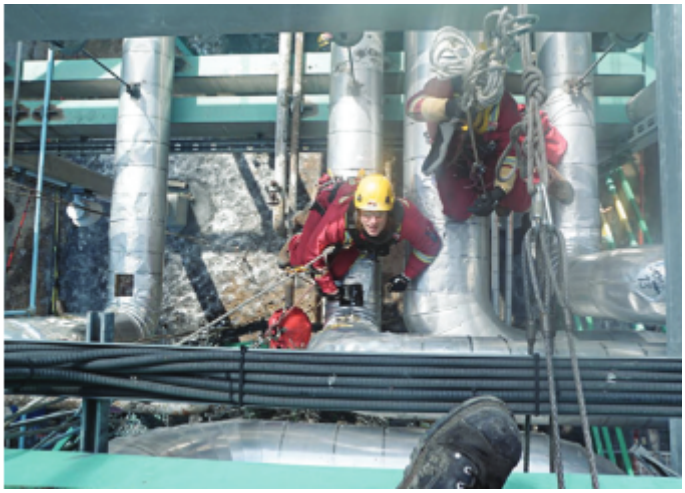

Figure 2. Using handheld XRF analyzers, an inspector conducts rope access PMI at a Canadian refinery.

Why use rope access over traditional access methods like scaffolding? Rope access solutions allow for work to be carried out quicker than scaffolding, keeping costs and job durations to a minimum. It was reported that one project using rope access led to a savings of more than $1 million compared to using scaffolding for the same project. The savings came from a reduction in manpower, along with fewer materials rented, and replacement power costs. There is also a safety component in accessing difficult-to- reach locations by rope. The Industrial Rope Access Trade Association (IRATA) reported in 2014 an accident/incident rate of less than one per 100,000 hours of work on ropes since 2015, and less than 0.5 for the previous five consecutive years. That figure, IRATA reported, is far below industry standards and conventional means of access.

Lamb first combined rope access with XRF technology in 2009 on a project with one of Canada's largest oil producers , testing low alloy and stainless steel piping circuits – with more than 250,000 individual components. Working with this energy company, Lamb and his team developed an effective and efficient inspection process in order to execute and deliver the data required in a timely manner. Lamb quickly realized that the method and technology combined to offer unprecedented efficiency. He immediately explored the idea of replicating this retroactive PMI program for other clients, regardless of how large or complex the project.

In early 2013, a metallurgy-based failure at a refinery in Saskatchewan presented an ideal opportunity for Tacten to use rope access and XRF analysis for PMI. What began as a small scope-of- failure analysis bloomed into a full scale retro survey. The company was prepared with inspectors, procedures, report templates, and proven plans to execute. An upgrade in handheld XRF technology allowed the team to collect even more accurate data and allowed the client to gain a complete understanding of the metallurgy contained in their assets.

Embracing XRF

Settling upon rope access and adopting handheld XRF technology are two distinct yet connected decisions. XRF technology in a handheld form allows users to reduce costs by identifying materials quickly, discovering issues before they turn into bigger problems, and protecting workers, facilities and brands. Handheld XRF provides documentary evidence that reasonable quality procedures have been used in building any plant or facility where failure could have serious consequences.

As Lamb notes, *"We have mastered this process and continue to find new ways to improve. We are committed to following strict safety guidelines as outlined by the IRATA. Doing that, while also ensuring that we are equipped with the most advanced handheld technology, means that we can only improve our process and efficiency in the months and years to come."*

Perhaps the most important takeaway is that inspections should not wait until a costly failure occurs. Refineries and plants should initiate a retroactive PMI program proactively – even if a full inspection seems like a daunting and time- consuming endeavor. The technology available today can lead to reductions in risk, increases in productivity, and more efficient inspections. By following these and similar methods, businesses can keep their personnel safer and their bottom line in better shape.

About the Author

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Brian Wilson is the business development manager, energy markets, for portable analytical instruments at Thermo Fisher Scientific. He has more than 15 years of experience in x-ray fluorescence (XRF) and optical emission spectroscopy (OES) elemental chemistry techniques. His current focus is on handheld XRF applications for the oil & gas industries, as well as petrochemical, power... Read more »

Comments and Discussion

Posted by **[Removed]** on September 6, 2016

It would be really good if the author could share some actual failure rate data, even more so if the find rate of incorrect material could be correlated to the age of the plant.