Using AI, RPA & Machine Learning to Drive Operational Excellence at Koch Industries

In the lead up to the 2020 Digital EHS in Oil and Gas ONLINE event, we caught up with **Sheryl Corrigan, Director, Environment, Health & Safety, Koch Industries.** Here, Sheryl provides insight into how the company is working to create next-generation leak detection technology for the oil and gas industry.

At last year's IQPC Operational Excellence in Oil & Gas Summit, you spoke about how Koch Industries is using new technologies such as robotic process automation (RPA), machine learning and robots and cobots to drive operational excellence. Can you provide us with an update on these projects and initiatives?

At Koch we are focused on unleashing the power of our employees across the organization to transform. As a foundational question, we're asking individuals how they can they do their own work differently, and how can they contribute to larger process and company-wide transformations?

This is consistent with one of the key themes I talked about last year- the concepts of transformation and new-to. I showed a video of one of our accountants using robotic process automation for her work. I also talked about the analytics solutions, machine learning, robots, and cobots that we use in our plants. In the case of the accountant, it was a new-to-me example. The other examples are new-to-industry or new-to-our business. Since last November, we've been building on these new-to concepts and applying them across our businesses at Koch.

A specific example of analytics and machine learning that has helped us gain extraordinary insight into some of our processing units is central control rooms.

At Georgia-Pacific, we have a central control room where we have paired our paper-making facilities' technical knowledge and skills with sensor technology. This enables us to understand how our machines are operating in a more granular way than our existing plant-wide information systems. After looking at the data, we've found that these sensor networks provide more detailed information about our machines and equipment, so we're often able to see small failures and prevent unplanned events before they happen. With the addition of our analytical and machine learning capabilities, we are faster at detection, giving us higher availability than we had previously.

This year, you're going to be speaking about Koch's partnership with the Environmental Protection Agency's (EPA) Office of Research and Development to create next-generation leak detection technology for the oil and gas industry. Can you tell us more about this?

Several years ago, our environmental team came up with an idea about leak detection and repair, which is an environmental regulatory requirement for many chemical processing and manufacturing sites, as well as for the oil and gas industry. Currently, we dispatch technicians to walk delineated routes in the plan to test valves, connectors, pumps and other equipment for leaks using hand-held VOC detection devices. Given the size and scope of petrochemical facilities and other similar operations, this is a significant undertaking. To provide context, there can be hundreds of thousands of leak detection points that need regular monitoring at a large facility

It is a daunting job—often requiring individuals to climb towers, make their way through complex processing units, and deal with the elements to access equipment in remote locations. Our team wanted to make this job safer, more effective, and more predictive. We wanted to know, for example, how could we find the leaks before they started leaking? And importantly, what is causing the leaks so we can make changes designed to eliminate or significantly reduce them?

In search of a better way, our environmental team at Flint Hills Resources teamed up with Molex, a Koch electronics company, and the Office of Research and Development at the EPA on a novel idea – to put an array of sensors in a processing unit and use those to detect leaks. The sensors would be deployed near components that are subject to the lead detection and repair requirements and would be used to detect leaks—versus sending a technician to do the detection manually. Once the network finds low-level detections, the system estimates a leak area, and then sends an alert dispatching a technician to the location to validate the leak and attempt a repair, if possible. We're in the early phases of testing this methodology, but the data look very promising. It is not rocket science by any means, but it alleviates a huge portion of technicians' work.

By using this sensor network and ultimately applying data analytics, we think we can start to predict the most likely scenarios for a leak. The result will be even better operations and better air quality.

How will this technology impact operations at Koch Industries, or specifically, Flint Hills Resources?

One, it's an opportunity to eliminate the need for technicians to routinely interact with process equipment in operating facilities—which reduces the probability of a safety incident. If the technology is successful, it will be working 24/7—not our technicians.

Two, we think we're going to be able to actually reduce the number of leaks through deeper understanding of the data. We are looking to apply machine learning and modelling to help us predict and ultimately prevent leaks. This would reduce our overall emissions, which is good for us, and good for society.

Three, we really believe that this technology will lead to better operations. We'll have a better sense of where these leaks occur, and in turn, we'll be able to head them off at the pass and identify changes in the way we are operating. There may be opportunities to change equipment, materials, piping, as well as our procedures and processes to potentially improve our performance.

What do you predict as some other key efficiencies that can be achieved compared with current leak detection methods?

The current method requires a significant amount of manpower to collect the data and report—especially at larger sites. The sensor system would gather data faster, more safely, and more cost-effectively, and we would be able to generate reports in a more automated way.

Maintenance and repair are factors. If we can reduce the number of callouts for our maintenance teams, that's a reduction in cost. From an operations excellence standpoint, it also frees up maintenance teams to do higher-value work.

What prompted Koch Industries to partner with the EPA to develop this remote leak detection technology?

Transformation. The environmental team thought and then acted on an idea: there has to be a better way to do this. Employees realized they didn't have the capability they needed to solve the problem themselves, so they found partners who had the same vision and drivers to create something valuable for us and for society. EPA has been an excellent partner—providing resources, insight, and direction that has been critical to the success of the project so far.

So, when do you hope to make this technology operational? And how are you preparing your workforce for the change?

We don't have a launch date for commercialization. We have a prototype that is being piloted in cooperation with the EPA at Flint Hills Resources' facilities in Texas. We have more beta testing ahead to make sure this new technology is better than the existing alternative. Once we prove the technology is effective, we will work on a path for approval by EPA and become fully operational.

Our employees in the leak detection and repair groups across our facilities are excited by the possibilities of doing this work differently, with better results. They have been involved in the design, experimentation, and piloting of this technology, which has crucial in our success. With their knowledge and expertise aiding the team at every stage, a product that we think will change the way leak detection is handled is on the horizon. It's very exciting for all involved.

Are there any other technologies that Koch is using that you're particularly excited about?

Our Koch Chemical Technology Group is doing a lot of work with smart combustion right now. We're applying smart technology to specific steps in the combustion process in order to make furnaces more efficient. We're analyzing the way they operate in the firing chamber with new technology and tools like laser-based systems for real-time flue gas composition and temperature measurement for real-time combustion analysis.

This helps us gather real-time data that we can bring into a data lake, where we can perform adaptations and learn how to improve or optimize the process. By allowing for machine learning and predictive technology, we can ultimately achieve autonomous operations.