



Case Study:

Boiler Robotic Inspection and Cleaning at BASF

At A Glance:

Problem: Safety and efficiency in boiler inspection and maintenance

Solution: Boiler Robotic Inspection & Cleaning (BRIC) to assess, clean and map the boiler

Outcomes

- 66% reduction in time for inspection and maintenance
- No human entry to confined space
- Remote high-pressure cleaning
- Precise measurement of tube wall thickness

Background

The company's tagline sums up its focus, "We create chemistry." Despite the brevity of its banner, BASF is anything but small. The German multinational is the largest chemical producer in the world. Its subsidiaries and joint ventures dot more than 80 countries and operate six Verbund production sites and 390 other production sites in Europe, Asia, Australia, the Americas, and Africa.

For BASF, Verbund, or the integration of materials systems and processes to deliver unparalleled efficiencies, is the key to creating value for its clients. This approach creates efficiency that extends through each of its products and services. For an operation that annually generates some \$72 billion in revenue, efficiency is critical to ensuring that the company moves with marked assuredness.

Look no further than BASF's Antwerp production facility to get a picture of its commitment to efficiency. Production at the company's largest facility requires about 1,000 tons of steam every hour. 800 of those tons are derived from the recovery of on-site surpluses. This is facilitated by an intelligent network between exothermic and endothermic chemical processes, which recovers 90% of the heat created at the facility. BASF has also lowered the output of other waste by more than a third over the last decade.

Targeting Success

BASF has created lofty goals for its organization. As expected from any modern multinational company, profitable growth, sustainable product portfolio, responsible procurement, and employee engagement top the company's targeted objectives. BASF's 2020 report on its economic, environmental, and social performance also lists resource efficiency and safe production as essential focus areas.

Its goal: Reduce the worldwide lost-time injury rate per 200,000 working hours to ≤ 0.1 by 2025.

Along with efficiency, BASF leadership holds process safety as a core part of safe, effective, and thus sustainable production. At its Verbund site in the harbor of Antwerp, which operates approximately 55 separate production plants, Jürgen Moors oversees facilities operations. His areas of responsibility include management of wastewater processing, demineralized water production and distribution, cooling towers, and 500 kilometers of pipeline. His greatest challenge, however, is limiting the downtime of these utilities at the facility.

With 55 plants at the Antwerp site, there is never a ubiquitous downtime. Plants are always in operation and require the utilities supplied by Jürgen and his team. Finding opportunities for efficient maintenance and inspection to minimize the downtime of the plant within a plant is a critical pursuit.

Jürgen's team is also responsible for six boilers at the Antwerp facility. The boilers, which can never be offline concurrently, balance the steam and condensation grids

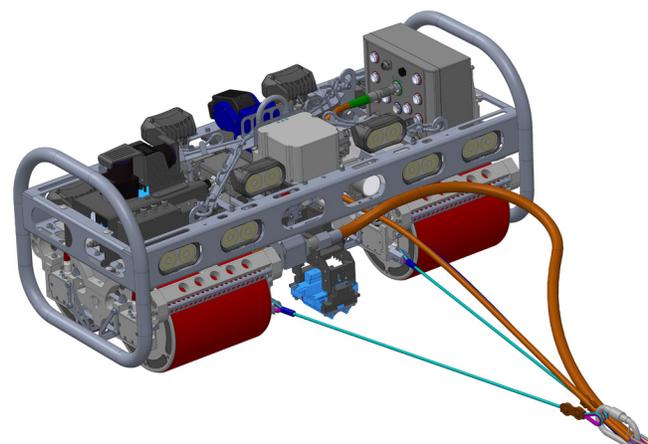
for the entire facility. The obligatory, bi-annual inspection and maintenance of the boilers has traditionally been among the team's most time-intensive activities. The challenge with performing the inspection and maintenance operations comes down to time and safety.

Inspection and maintenance of boilers are complex operations. Cooling the unit to 30°C / 86°F, the maximum temperature for human entry is a multi-day event. Next, the assemblage of scaffolding within the boiler, which provides workers with the required platforms for inspection and cleaning, can take several shifts to erect. The final steps require workers wearing specialized safety gear and breathing apparatus to enter the boiler through a manhole. The workers then manually clean corrosion and scaling from the boiler's water wall and inspect its integrity. Ultimately the boiler is recommissioned for operation, and the process is repeated on the remaining boilers.

Pursuing A Robotic Approach

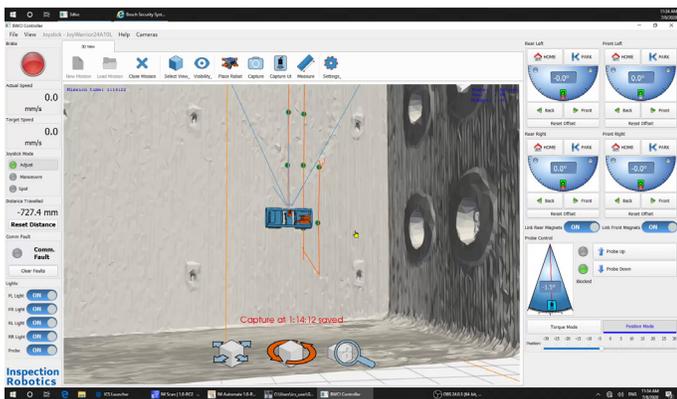
Always on the lookout for opportunities to do things with greater efficiency and increased safety, BASF reached out to Waygate to explore options for the boiler maintenance and inspection process. Together the companies explored the use of various technologies. Drones were among those. While the flying devices proved effective for point inspections of minor leaks, they were insufficient for a complete maintenance cleaning and regulatory compliant inspection.

Waygate understood the determination of Jürgen's team to find a better and safer solution to the complex boiler inspection



problem. The answer came in the form of Boiler Robotic Inspection & Cleaning (BRIC). BRIC uses advanced robotics to keep humans out of confined spaces while delivering high-quality data through three innovative inspection technologies: an HD camera facilitates close-up inspection, 3D location technology, geo-tags problem areas which can be mapped to digital drawings of the boiler, and an ultrasonic probe conducts precise measurement of tube wall thickness.

The robotic boiler wall-crawler quickly proved itself. It enabled the boiler to be cleaned using powerful high-pressure waterjets that operate at 500bar / 7250psi.



Enough to clean the most stubborn debris. Because the device can climb the boiler's wall autonomously, the time-consuming put-up and take-down of scaffolding are eliminated, minimizing the isolation time typically required. Rounding out BRIC's attributes is safety. No longer did boiler inspection require humans to enter the confined space to perform a regulatory compliant inspection.

Promise for the Future of Boiler Inspection

Jürgen Moors characterizes BRIC as a huge opportunity for BASF. He says the system provides the possibility to close a gap on the boiler inspection timeline,

“Where for an inspection we normally have to calculate about three weeks, with this system now we can go to one week. So, we win back about two weeks of downtime on an inspection.”

In the past, the physical inspection of the boiler was an uncertain variable. Now, variability is confined to basic boiler maintenance.

Jürgen attributes the success of the BRIC introduction to the willing cooperation of Waygate. Despite numerous tests and reviews by multiple functional areas, including maintenance, inspection, and asset management teams, Waygate remained committed to ensuring BASF realized the efficiency and safety it had set out as corporate goals within its boiler inspection and cleaning processes.

About Waygate Technologies

Waygate Technologies, a Baker Hughes business, is a global leader in non-destructive testing and examination solutions. The company holds over 125 years of experience in ensuring quality, safety, and productivity in industrial settings.

Today, the company helps its customers by applying state-of-the-art data and analytics for best-in-class insights on their products and processes. Through BRIC, customers benefit from safe, data-driven, and disruptive boiler inspections programs.