Baker Hughes

Case study: China

LeakID test quickly identified type and location of dangerous cooling tower leaks

A refinery in Northern China was experiencing numerous hydrocarbon leaks in their recirculating cooling water. They had been trying to identify the causes and locations of the leaks for more than a year, but without success. Normal practices of trying to catch samples and run analysis had failed to identify the type or source of the leak. The refinery's cooling water circuit was very complex, feeding more than 150 heat exchangers in 12 units. Pitting corrosion related to biofilms and microbiologically induced corrosion (MIC) was suspected as the major cause of repeated heat exchanger failures, loss of production, and safety concerns due to chemical exposure for their employees.

Because the incumbent water treatment supplier had been unable to find and fix the problem, the refinery management was willing to seek alternate solutions from competitors. The local Baker Hughes representative and technology team were asked to visit the refinery and develop a plan of attack to identify the type of hydrocarbon and pinpoint the leaking heat exchanger. The team decided to focus on the north cooling tower, which had the following specifications:

- Six cell cooling tower
- Counter flow design
- Slat fill
- 66,000 m^3/hr (design)
- Approximately 12 process areas on two main headers
- Microbiological growth controlled by bleach (slug fed to one of two sumps/day)

First, the Baker Hughes team used the LeakID™ rapid hydrocarbon identification test to identify the type of leak as most likely benzene. Then the team studied the piping diagram of the cooling system and established key sample points required to survey the system, focusing on the areas of the refinery where benzene could leak into the cooling water. Major branches of the system were tested using an oxidation reduction potential (ORP) meter, and suspect branches were identified as possible sources of the leak(s).

This allowed the Baker Hughes team to narrow the search to specific units within the refinery, and within a day and a half, the leaking heat exchanger was identified. The cooling water supply header going into the suspect unit had an ORP value of approximately 150 mV, while the cooling water return header leaving the unit had an ORP value of -250 mV .The source was found and confirmed by the LeakID test with excess of 10 ppm benzene. Further work with the ORP meter pinpointed a second series of leaking heat exchangers.

The refinery management was extremely grateful for the quick and professional manner in which the Baker Hughes team identified and pinpointed the leaking heat exchangers. Safety was improved by eliminating the emission of a carcinogen from the cooling tower. Production losses were reduced, and the refinery realized an increase of profit in excess of $100,000 USD (6.3 million Yuan) per year.

Challenges

- Identify the type and location of numerous hydrocarbon leaks in a complex cooling water circuit
- Find a leak the incumbent water treatment supplier had been trying to find for more than a year
- Minimize operational losses and safety risks

Results

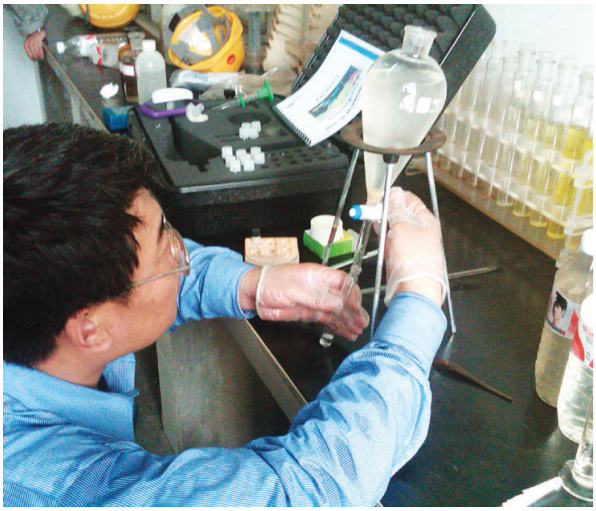
- Identified and located the leaks within two days
- Improved safety by eliminating benzene emissions
- Minimized production losses
- Increased refinery profit in excess of $100,000 USD (6.3 million Yuan) per year

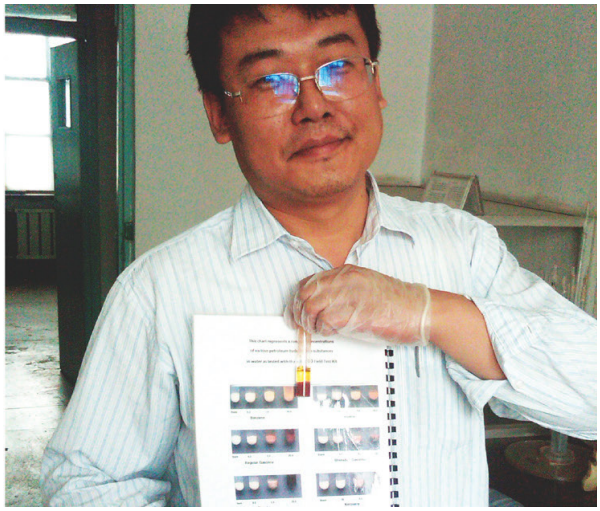
The Baker Hughes team also made several recommendations to further increase efficiency and profitability:

- Remove the leaking heat exchanger from service and repair
- Maintain a constant free available chlorine (FAC) residual of 0.3 to 0.7 ppm to control microbiological growth
- Monitor sessile bacteria with a Baker Hughes customized corrosion and sessile monitor
- Use LeakGuard™ leak detection and mitigation services to control hydrocarbon leaks
- Use BioKlenz™ biofilm control program as the primary emergency and maintenance solution
  - Eliminate under-deposit microbiological sessile corrosion
  - Improve heat exchanger efficiency due to cleaner surfaces and removal of biofilm

This case history is presented for illustration purposes only, as results may vary between applications.

Hydrocarbon leak in cell one of north cooling tower basin.





The LeakID test is a proprietary investigative tool used by Baker Hughes engineers to identify and quantify the type of hydrocarbon leaks in cooling water systems. The refinery had several possible locations for benzene leaks.

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