Oil Condition Monitoring Case Study

OIL ANALYSIS PROVIDES INFORMATION VITAL TO DETERMINING ROOT CAUSE OF WATER CONTAMINATION IN INDUSTRIAL GEARBOXES

SYNOPSIS

This case study illustrates how routinely monitoring equipment and lubricant condition can effectively identify the root cause of water contamination in two Autoclave gearboxes critical to a chemical manufacturing plant's operations. The resulting investigation allowed maintenance personnel to take corrective action before water ingression caused abnormal wear significant enough to affect equipment performance and negatively impact operational costs.

CASE STUDY **OVERVIEW**

Industry: Chemical Mfg. / Refining

Est. Annual OCM Spend:
Plant Spend – $14,800

Est. Cost Savings:
Gearbox replacement – $90,000
Downtown time – $100,000/day

BACKGROUND

The Autoclave is the site of conversion of raw material into product – also called the heart of a chemical process. The design of a chemical reactor where bulk drugs are synthesized on a commercial scale depends on multiple aspects of chemical engineering. Since it is a very vital step in the overall design of a process, designers ensure that the reaction proceeds with the highest efficiency towards the desired output, producing the highest yield of product in the most cost effective way. The gearbox on this unit is a critical component as it drives the reactor. Therefore, routine monthly sampling of the lubricant is performed to ensure optimum performance. Testing includes the following:

- Appearance
- Spectrochemical Analysis – 21 Metals
- Viscosity @ 40° in cSt
- Acid Number
- % Water
- % Free-Standing Water
- Direct-Reading Ferrography
- Micro-Patch Debris Analysis

CASE STUDY

On January 22, 2015, routine monthly sampling of Autoclave gearbox #4 identified 1.5% water in an emulsion. Until this sample, the gearbox had no history of water present in the lubricant. Based on the significant level of water present and taking into consideration the criticality of the component to plant operations, the laboratory recommendation was to change the oil, investigate to determine the source of water ingression and resample to confirm that the maintenance recommended improved lubricant condition.

On February 27, 2015, a sample from Autoclave gearbox #4 revealed no water in the lubricant sample while a sample from Autoclave gearbox #1 showed water content 3 percent in an emulsion. The oil was changed and sampled again on March 11, 2015, to reveal an increase of 5% water in an emulsion. By March 25, 2015, the water content had increased to 15 percent in an emulsion. **See Figures 1-5.**

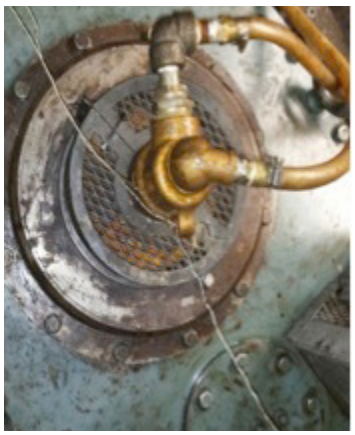

Figure 1 *– Top view of the Autoclave gearbox showing the water supply to the rotary joint*

For details about this Case Study contact our Customer Care Center on +1 800 655 4473 or ocm@bureauveritas.com

Figure 2 *- Side view of the Autoclave gearbox rotary joint*

Figure 3 *- Autoclave bearing and shaft cap removed revealing the underlying gearing. Cooling water is directed down the hollow center portion of the shaft*

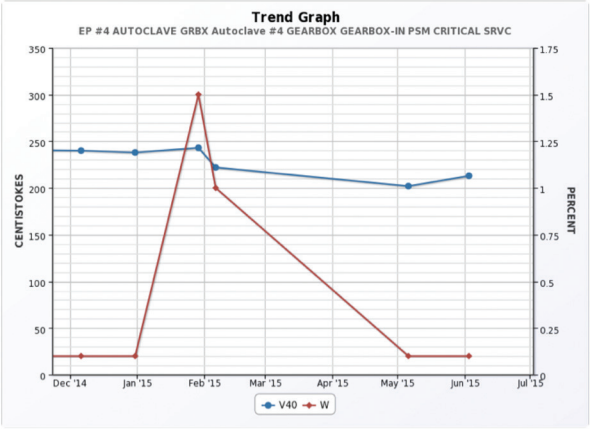

Figure 4 *- LOAMS[SM] Trend Graph illustrating the water concentration present in the lubricant sample of gearbox #4*

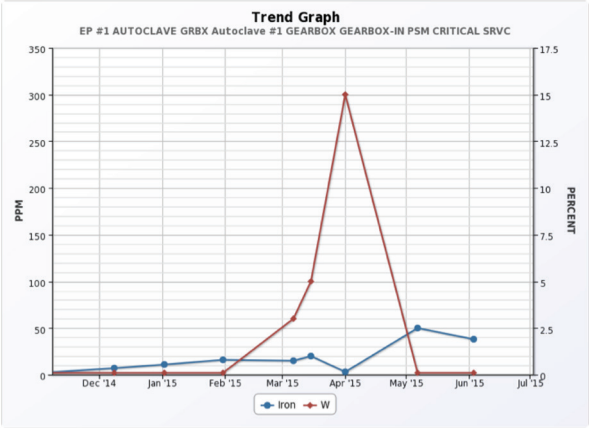

Figure 5*- LOAMS[SM] Trend Graph illustrating the water concentration present in the lubricant sample of gearbox #1*

KEY FINDINGS

A leak was discovered and repaired in the water inlet located on the top of the gearbox #4. Eighteen gallons of lubricant were drained from the component and replaced. Maintenance personnel then confirmed that component operation was noise-free, the lubricant supply was contaminant-free, bright and clear and that it had been stored properly prior to use. However, a second sample, drawn on February 4, 2015, again confirmed excessive water in the lubricant in the 1 percent range.

A MicroPatch test was performed to determine the source the water ingression by identifying any unusual wear occurring or the presence of debris or contamination. An examination of the debris present did reveal that a degree of abnormal wear was occurring although there were no visual indications of any possible sources of water. **See Figures 6-7.**

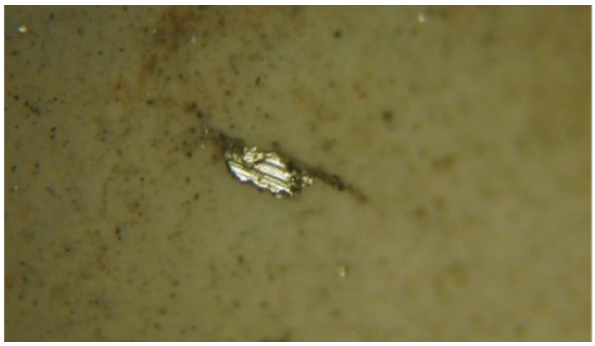

Figure 6 *- 150 micron ferrous fatigue chunk*

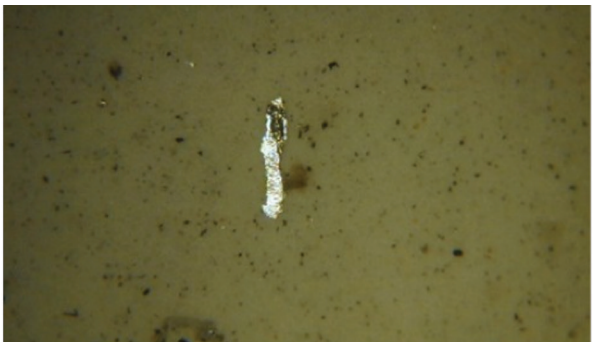

Figure 7 *- 160 micron ferrous sliding wear particle*

In both cases, the water leak was traced to a loose hose fitting on a rotary joint that directs cooling water down the hollow mixer shaft. The more obvious leak in gearbox #4 was corrected early while the leak in gearbox #1 was just a slight drip making it more difficult to identify. Sampling done April 30, 2015, revealed that the lubricant in both gearboxes was free of water.

CONCLUSION

Ongoing, consistent communication between the laboratory, plant maintenance managers and the chemical plant's corporate lubrication consultant continued until the water source was identified and corrected. While in operation, the components were inspected for the source of the water ingression and the oil and filter were changed. Inspection of external water entry possibilities was initiated throughout the investigation, the oil supply was tested and proper oil storage techniques confirmed.

Minor repair of the leaking rotary joint hose fittings and the man hours involved in the water source inspections and oil and filter changes cost the plant less than $1,000 for the two gearboxes combined. In comparison, plant personnel estimated replacement and lost production costs would have totaled several hundred thousand dollars.