



**BUREAU  
VERITAS**

## Oil & Petrochemicals Case Study

# FINDING CAUSE OF WATER CONTAMINATION IN INDUSTRIAL GEARBOXES

Oil Analysis program saves chemical plant from costly failure.

## 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 ingress caused abnormal wear significant enough to affect equipment performance and negatively impact operational costs.

## BACKGROUND

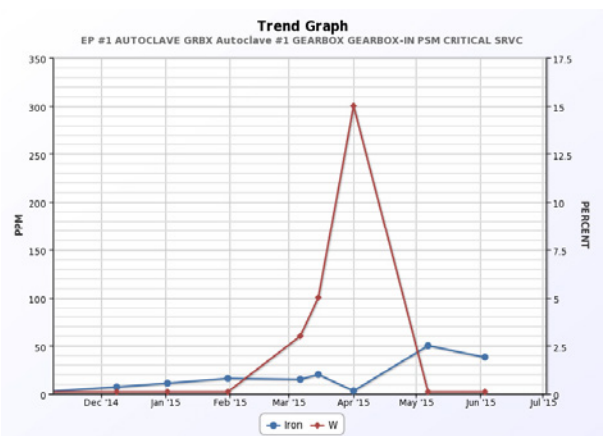
The Autoclave is the site of conversion of raw material into product – also called the heart of a chemical process. The design of a chemical reactor where bulk drugs are synthesized on a commercial scale depends on multiple aspects of chemical engineering. Since it is a very vital step in the overall 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. Testing includes the following:

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

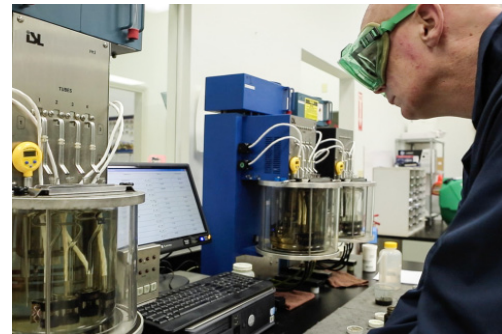
## CASE STUDY

On January 22, 2015, routine monthly sampling of Autoclave gearbox #4 identified 1.5% water in an emulsion. The gearbox had no history of water present in the lubricant. Based on the significant level of water present and the criticality of the component to plant operations, the laboratory recommendation was to change the oil, investigate to determine the source of water ingress 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.



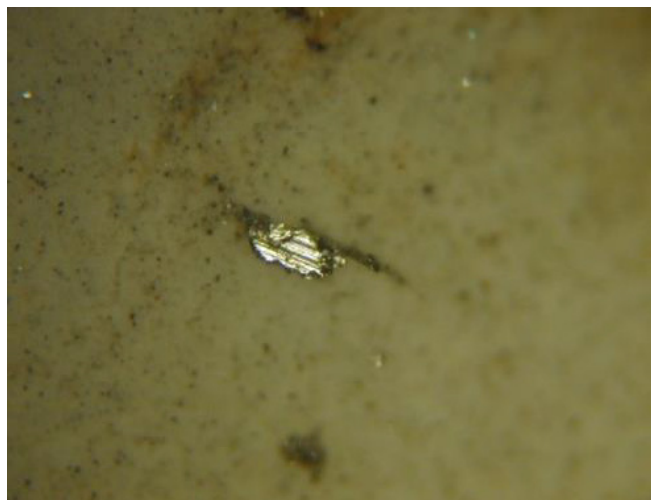
For details about this Case Study contact our **Customer Care Centre** on **+1 800 655 4473** or **ocm@bureauveritas.com**



## 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 of the water ingress 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.



150 micron ferrous fatigue chunk



160 micron ferrous sliding wear particle

## 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 ingress 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.