

## CASE STUDY

# Ferrography provides early warning of bearing failure, confirmed by vibration analysis.

### *Early detection of journal bearing failure is critical to equipment reliability.*

The equipment being monitored is a General Electric Turbine Generator supported by journal bearings.

This equipment has been monitored by Ferrographic analysis, Used Oil analysis, and vibration analysis for five years. The ferrographic and used oil analysis has been performed by Predict. The vibration analysis is provided by an in-house program.

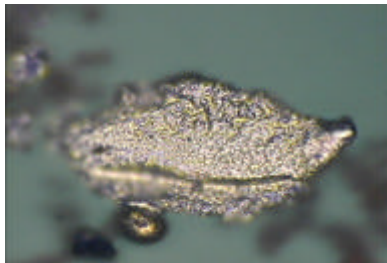


Figure 1

During the routine monthly testing, the wear particle concentration exceeded the statistical alarm for this unit. Analytical ferrography was performed due to the criticality of this equipment.

Upon examination of the ferrogram (wear particles deposited upon a glass slide for evaluation), babbitted material was identified (Figure 1). The babbitted particles were measured to 90 microns in size. The quantity of these particles observed was rated moderate to high. The size and quantity of particles present indicated a critical wear mode was

in progress and maintenance was required.

Used oil analysis showed acceptable results. Viscosity, FTIR, and spectrographic analysis were all normal with no indication of any wear or lubricant related problems. The reason spectrographic analysis failed to detect the current wear mode is it's inability to analyze particles over 8 microns in size. Babbitted particles are generated in larger pieces due to the physical properties of the material.

Vibration analysis utilizing standard analysis techniques and alarms did not identify the problem during quarterly analysis. Once the babbitted particles were identified orbit plots were utilized to monitor the wear mode prior to the next scheduled shut down.

During this time period orbit analysis (the graphical measurement of the shaft movement within a bearing) was also performed.

Journal #3 was identified through the vibration analysis as the bearing in the failure mode. The following vibration results were reported.

- Journal #3 is impacting a non-rotating element at the 7 o'clock position (Figure 2).
- The journal lift on the oil film shows only 2 mils lift. This indicates restricted or damaged bearings and/or seals.

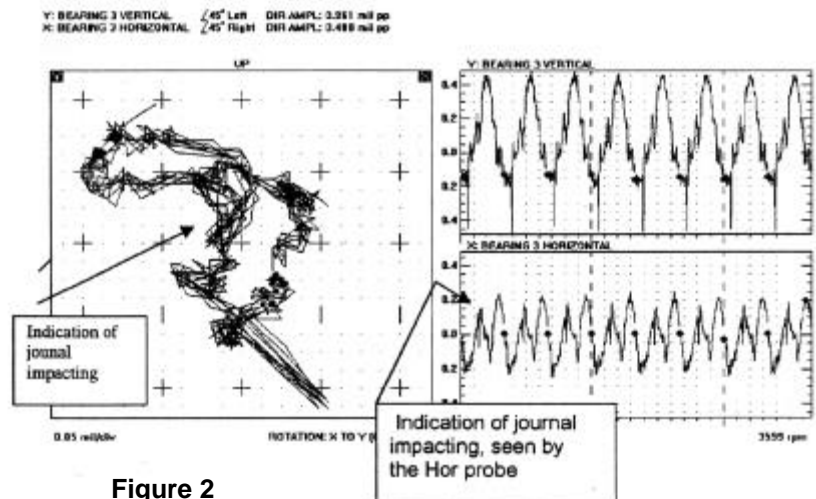


Figure 2

- Journal lift plot shows the journal is moving to the left side of the bearing as observed from the turbine end. Journal movement should be to the right.
- Vibration response of journal #3 is very low as indicated by the bode plots performed.

Conclusions from the ferrography and collaborating vibration analysis indicated a damaged bearing.

An inspection of this unit showed a wiped bearing. The timely identification of this failure mode saved our customer \$100,000.00.



**Magnified view of bearing surface**