

# So, Machines Vibrate!

## *You can save money by using vibration analysis*

By Mike Nelson

**A**t the last Board meeting of the Lackluster Sewer Authority, Klew Less, Plant Manager, had Fred Forecast explain some basics of predictive maintenance. This was in response to the Board's concern regarding the high cost of mechanical maintenance. Predictive maintenance has been shown to reduce overall maintenance costs. Mr. Forecast has returned and will now cover one of the many predictive maintenance techniques – vibration analysis.

Klew hands over the microphone to Fred Forecast. "Good evening Board members. We have ten minutes to cover the topic so you understand that only a foundation will be provided." Fred clicks the projector control and a slide appears on the screen:



### Vibration Analysis

- What causes vibration?
- Why use vibration analysis for predictive maintenance?
- Why do I need to measure vibration anyway?
- What tools do I use to measure vibration?
- On what points on the machine do I measure vibration?
- What are the steps involved?
- Who should analyze the information?
- What do they do with the information?

"Let us begin with":



### What causes vibration?

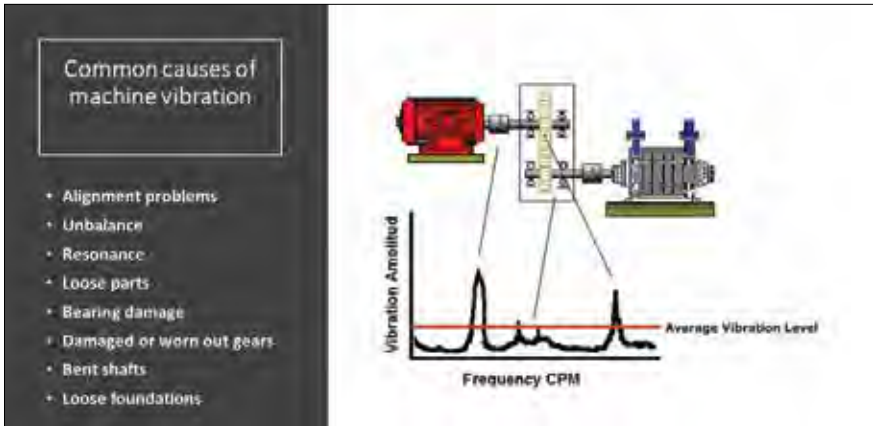
1776 Revolutions Per Minute (RPM) = 1776 Cycles Per Minute (CPM)

(Rotating shaft) (Sine wave)

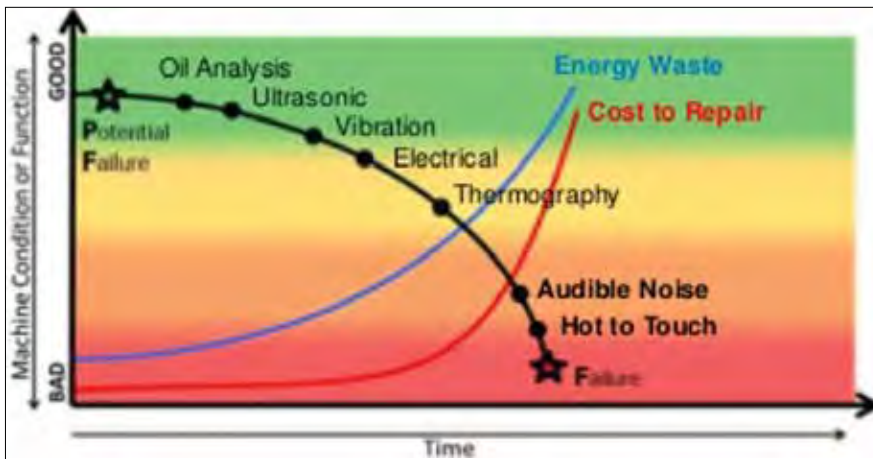
<sup>1</sup>Klew Less is Plant Manager at the Lackluster Wastewater Authority's treatment plant. He has been a central character of this column for over ten years.

**“BY WATCHING THE VIBRATION LEVEL, WE UNDERSTAND WHEN REPAIR IS NECESSARY. WE ALSO MAY BE ABLE TO INCREASE MAINTENANCE INTERVALS.”**

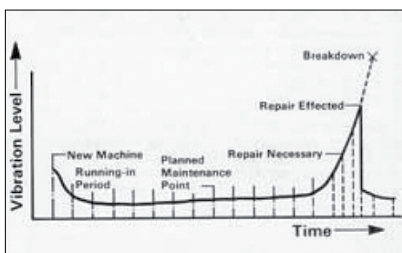
“Basically, because most machines rotate, various types of vibration are created. In this slide, we see eight common causes of machine vibration”:



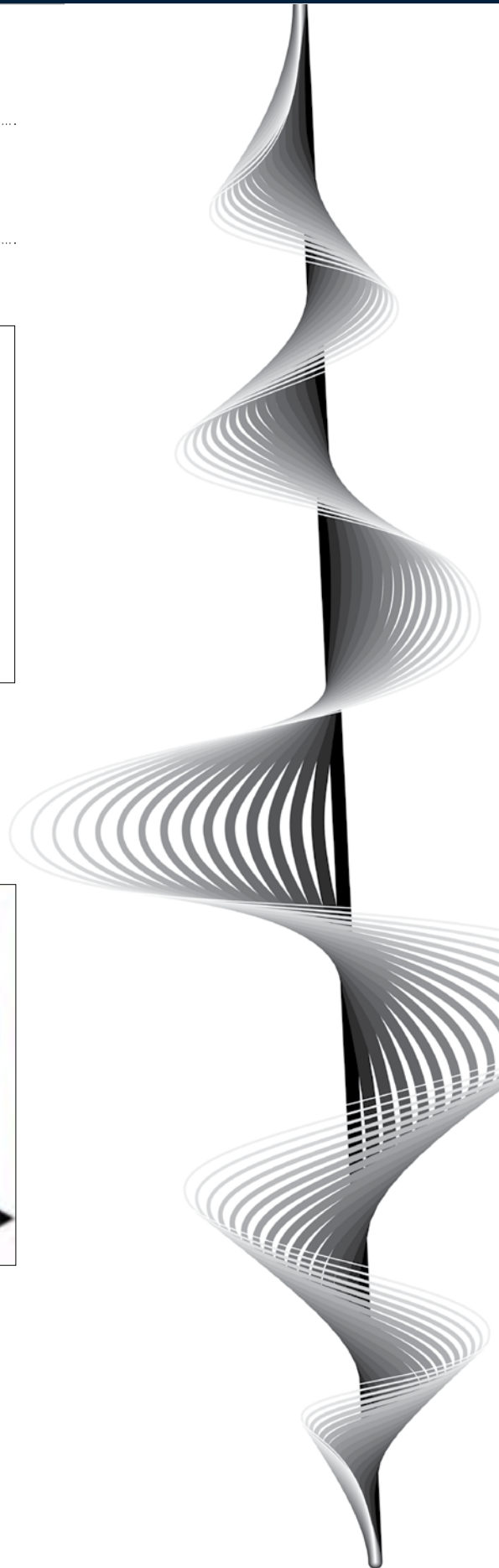
“Next, considering all the predictive maintenance techniques available, why choose vibration analysis? Vibration analysis is the best technology for diagnosing mechanical faults in rotating machines. It provides early warning of impending machine failure.” A Board member interjects, “Based on my experience, the easiest predictive technique is listening to the machine.” Fred Forecaster brings up a slide and responds, “I agree that hearing an unusual sound is easy and warns us, but if we look at the graph, you can see that the noise tells us we are close to failure, whereas the vibration gives us a much earlier warning”:



Mr. Forecaster continues, “The next slide answers the basic question of why do we need to measure vibration anyway?”



“By watching the vibration level, we understand when repair is necessary. We also may be able to increase maintenance intervals. Maintenance can be scheduled by need, not just by accumulated hours of operation. All of this translates to savings in maintenance and equipment replacement and increased equipment availability. Your operation runs 24/7. Reliability of the process is vital.” Fred brings up the next slide:





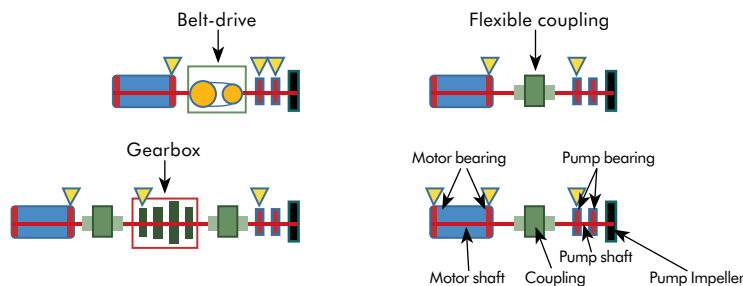
“First, the transducer, which nowadays is more or less universally used for vibration measurements, is the piezoelectric accelerometer”:



“The transducer or sensor can be used in portable or fixed applications. Here are three examples:

- Portable sensors and portable data collection.
  - Permanent sensors and portable data collection.
  - Permanent sensors and permanent data collection that provide machinery protection 24/7. Using SCADA, vibration can be trended and alarmed.
- A portable, general purpose vibration meter will usually be the most convenient measuring instrument to use.”

“Our next series of slides shows measuring points for a variety of machines”:



“Measuring points will vary with the type of machine, type of coupling, and the presence of belt drives or gearboxes. The yellow triangles mark where the transducer would be attached to the machine or where the probe of the vibration analyzer would be placed.”

The Board Chair interrupts: “There is certainly a lot to learn about vibration analysis. Fred and Klew, thanks so much for all this information. Because of time constraints, we must stop here. Mr. Forecaster, will you be available next month to cover the last three sections of your presentation?”

“It would be my pleasure,” answers Fred.

**ABOUT THE AUTHOR**



Mike Nelson is Past President of PWEA. He heads his own firm that specializes in helping operators obtain their Pennsylvania Department of Environmental Protection certifications and contact hours. Mike is a licensed operator and professional engineer. Refer questions or comments to [mnelsonh2o@aol.com](mailto:mnelsonh2o@aol.com). His website is [www.miknelsonh2o.com](http://www.miknelsonh2o.com).

