

# SCIENTECH STRESS WAVE SYSTEMS

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# My role with Stress Wave Energy

- 25 years with Dow Corning:
- The last 15 years in Reliability:  
Concentrating on preventative, predictive, and pro-active maintenance.
- Challenge over the last 5 years was to develop monitoring systems that provide indicators to impending failure to our operations teams.
- Our toolbox includes: Vibration, Ultrasound, Infrared, lubricant analysis, liquid flow measurements, “6 sigma” methodology.

## We became greedy! Asked questions.

- FMEA “Failure Modes & Effects Analysis” told us many of our failures originated from the way we operated our equipment.
- Is there a way to understand, quantify how process variables effected our rotating equipment?
- Could we respond to these indicators prior to developing mechanical faults to our equipment?
- Could these indicators be easily communicated to our operators so they can respond prior to faults developing?
  
- We believe the Sciencetech StressWave System tool has given us this ability to ask data driven questions leading to “root causes” of mechanical failures.

## **Voice of the Customer: “6 Sigma”:**

- **We need to better understand what is driving the failures of “Bad Actors” in our buildings.**
- **The output of any monitoring system must be easily understood by operations. Operations must be able to react to the data, “on their own”**





# Change in traditional thinking!!!

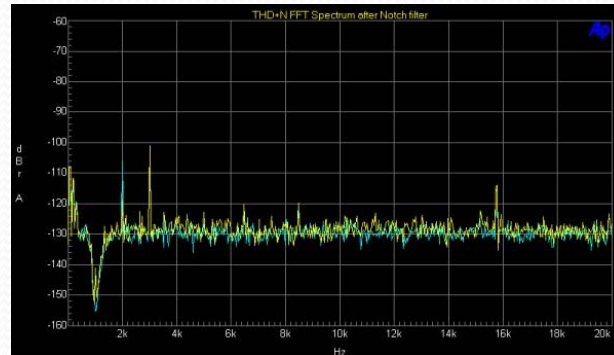
- **With traditional predictive technologies, (Vibration, Infra-red, and lubrication analysis): Change in trend means damage likely has occurred in the machine.**
- **With Scientech, a change in SWE level trend, does not necessarily mean you have damaged the asset.**
- **We are seeing the ability to identify “Root Causes” of mechanical failure, and react prior to damaging the asset.**
- **Having the ability to identify process conditions that affect the reliability of the asset, prior to physical damage has an enormous \$\$\$ and Safety impact.**

# Two Platforms

- **Permanent installations in the process building.**
  - Data will be sent to the operator control screens on a continual basis for optimizing machine operability, and early fault detection.
  - Sensors/ SWANguard SSP units are permanently mounted.
- **Portable SWAN unit:**
  - We have a “Bad Actor” hit team that is visiting plant areas and looking at their machines from an engineering perspective as well as setting up the portable SWANguard SSP unit and watching these machines for approximately 2-4 weeks.
  - The focus is to identify “root causes” and provide remedies. Then move on to other machines.

Knowing the condition alone is not enough....

## Health Care + Condition Monitoring



Normal coronary artery



Atherosclerosis



Atherosclerosis with blood clot



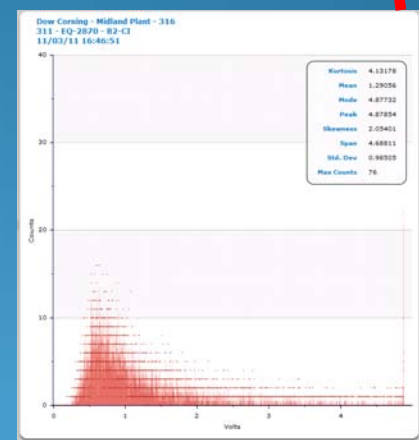
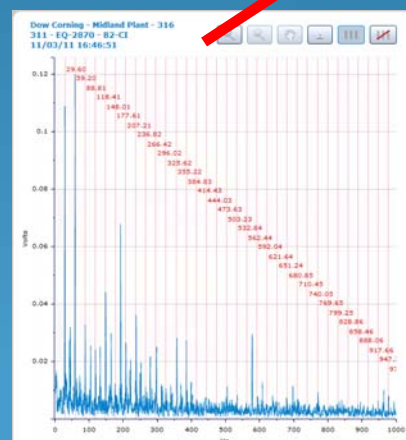
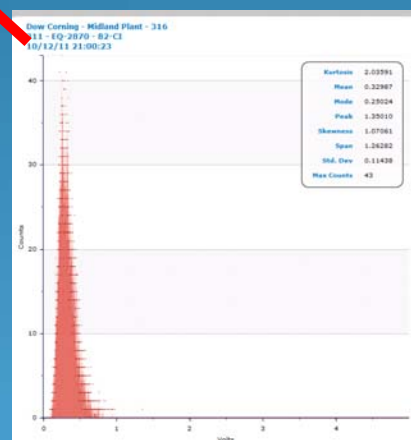
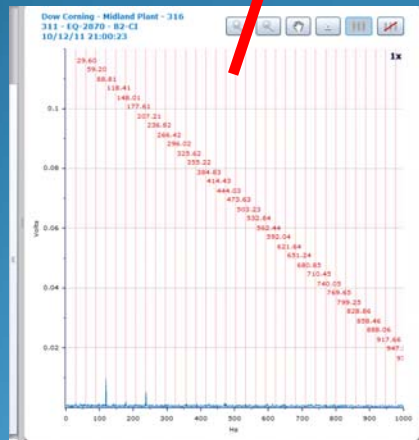
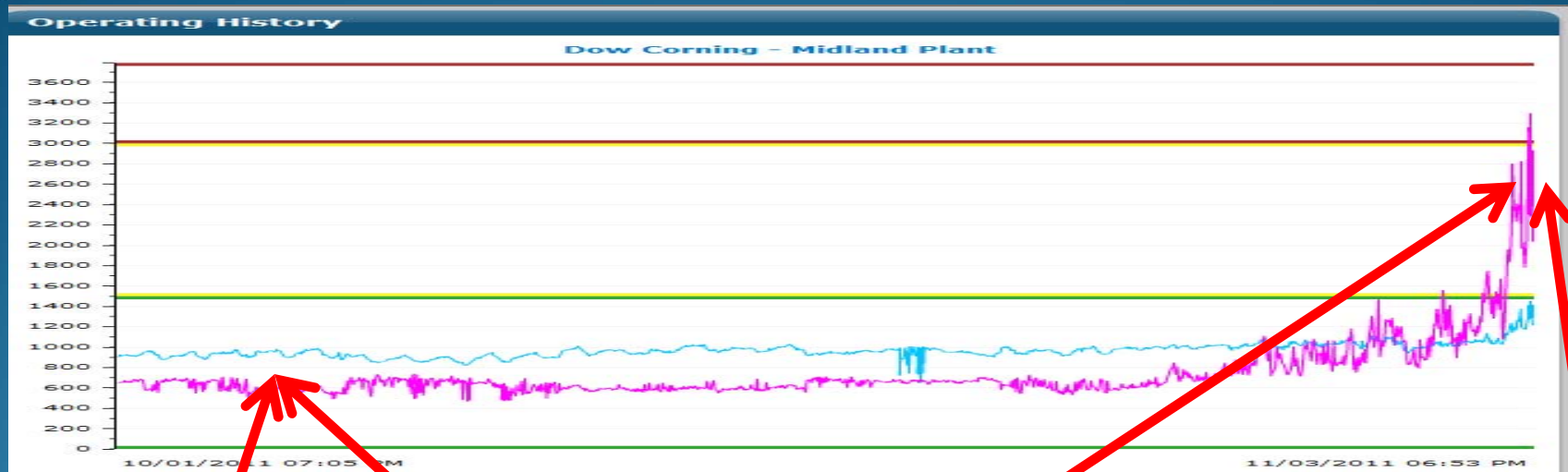
You can be healthy and yet experience different levels of stress, depending on how hard you are working (or how fast you are running).

If you **know** the operating conditions and environmental conditions, you can understand if the stress levels you see are appropriate (or not).

If you **know** the stress levels are not appropriate then you have a condition that needs to be managed before it becomes too late.



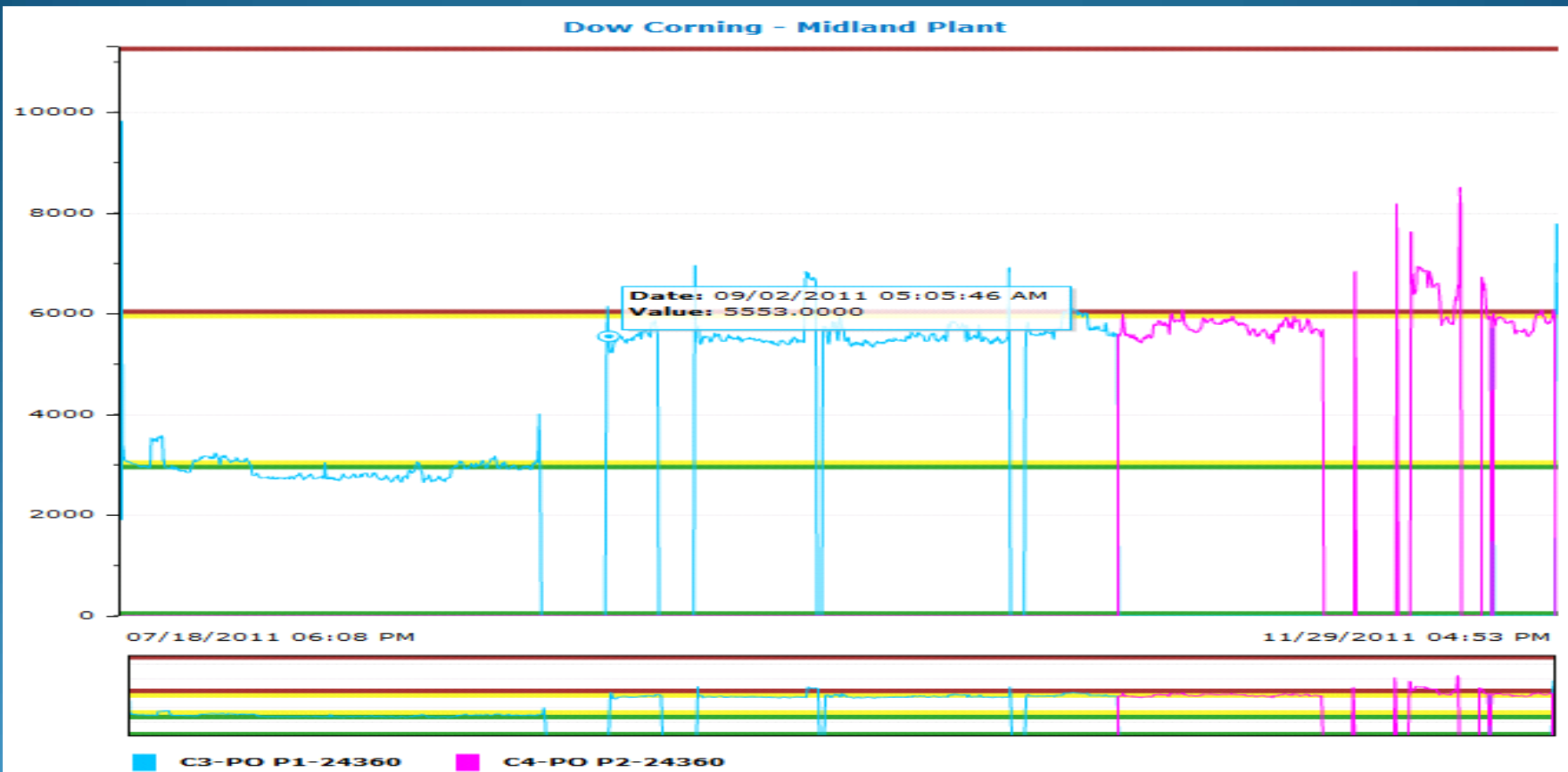
# SWAN data: Mechanical fault



The Stress Wave Energy exhibited an aggressive trend upward starting on Oct 31<sup>st</sup>. The Histogram and FFT data comparing low SWE to the Current SWE also indicates a dramatic change. We observed harmonic & non-harmonic peaks in the FFT. These peaks didn't correspond to historical fault frequencies. The histogram skewing to the right was also an indication of an unhealthy machine.

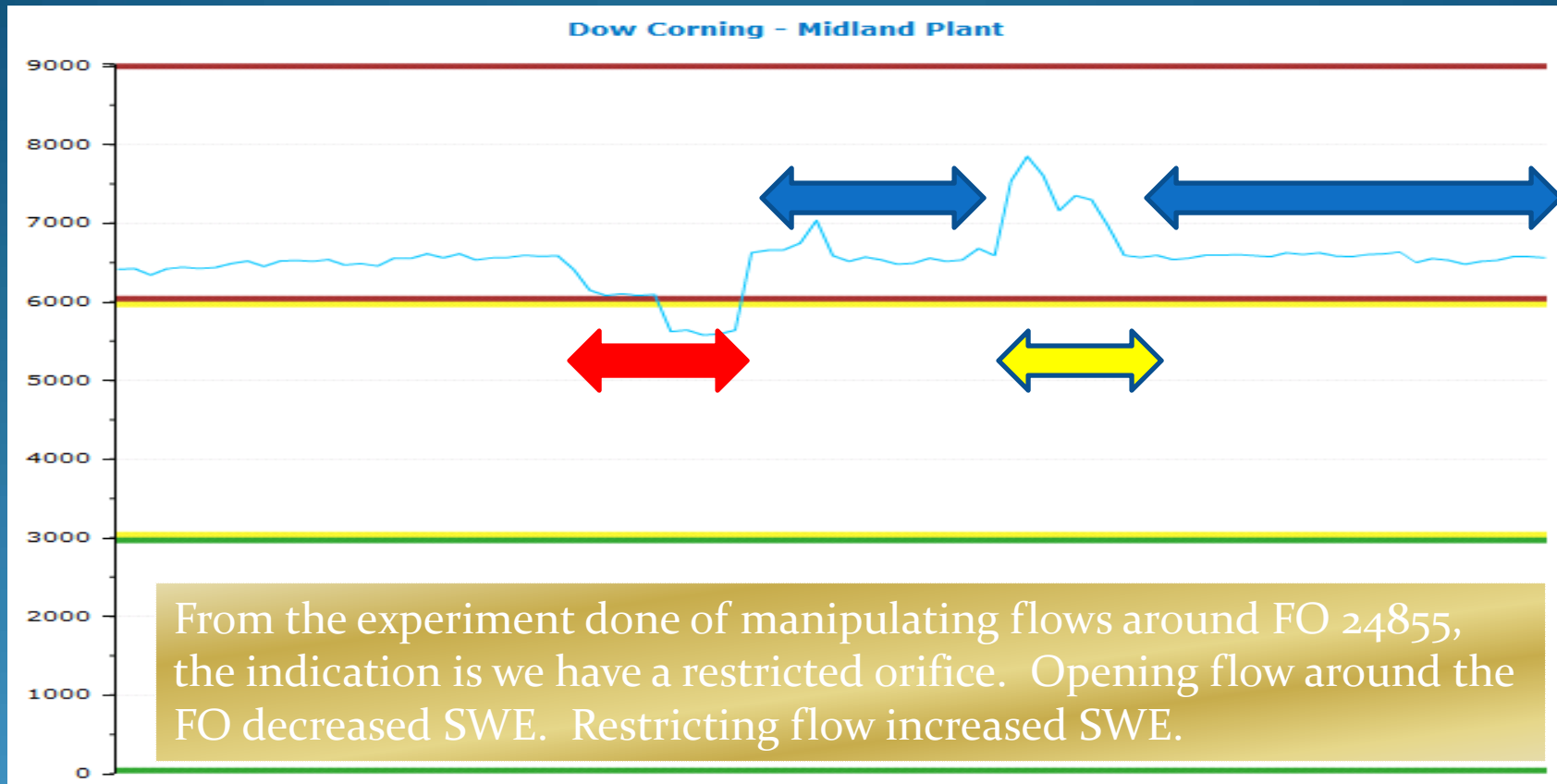


# 9/2/2011: Something changed : Common to both pumps.



On approximately 9/2/2011, there was a change in process conditions that affected the SWE levels for both pumps. This started us looking at what may have changed that could affect both pumps.

# Flow orifice troubleshooting:



Recycle Valve fully open: FO bypass fully shut: 

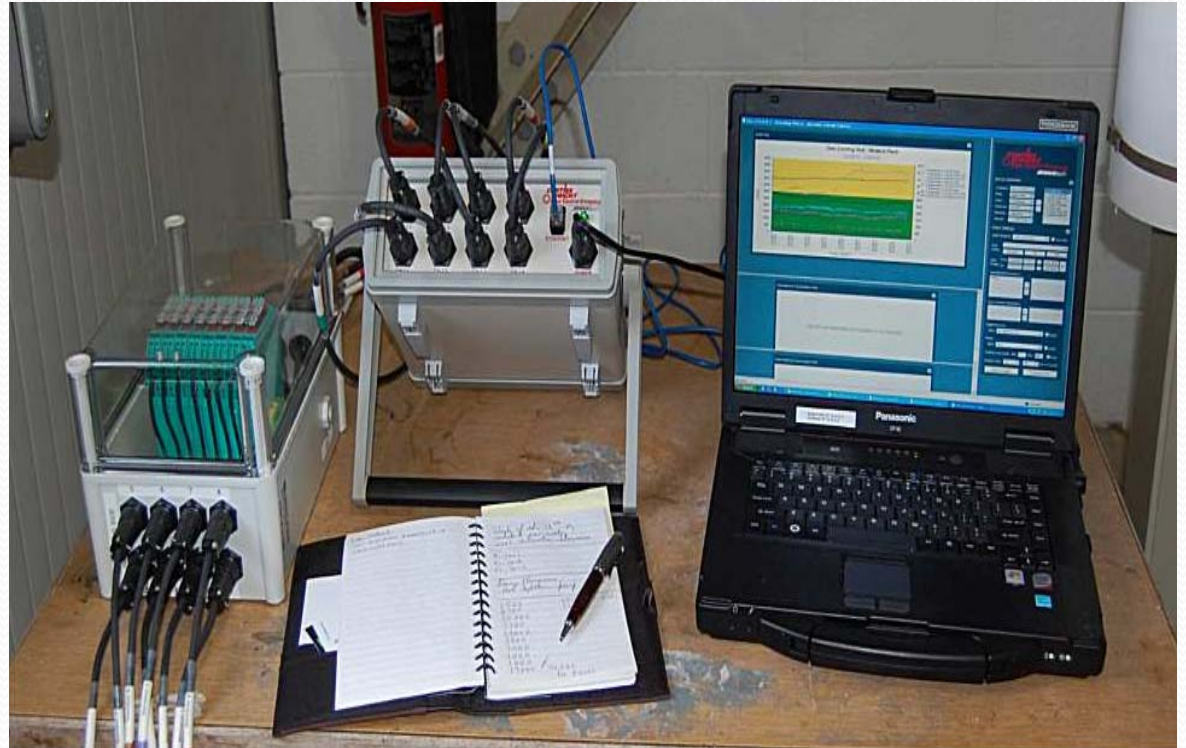
Recycle valve fully open: FO bypass open: 

Recycle valve closed 50%: FO bypass shut: 

# Portable Analysis unit:



**Magnetically mounted sensors.  
300 ft. cables.**



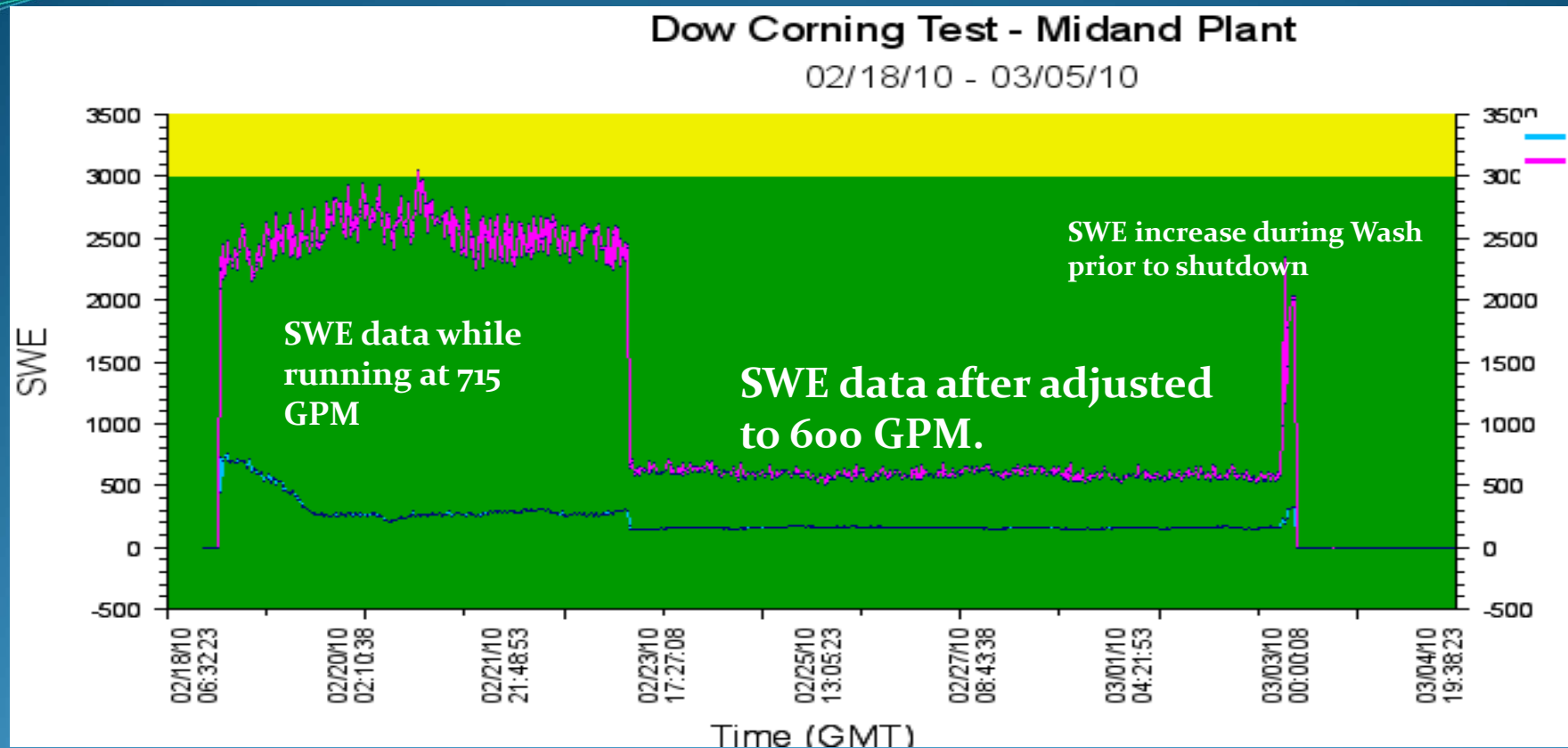
**Intrinsic barriers for area classification**

**SWANguard SSP data processor.**

**Laptop for storage and display of data.**



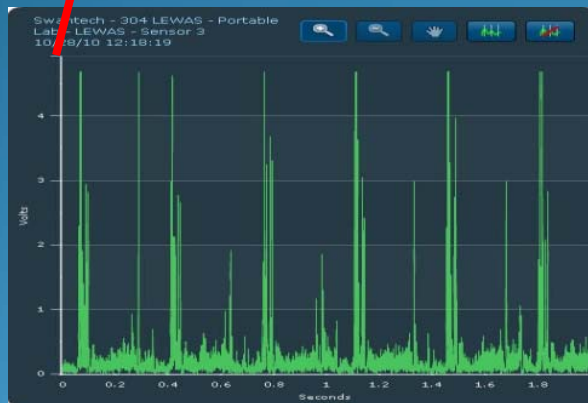
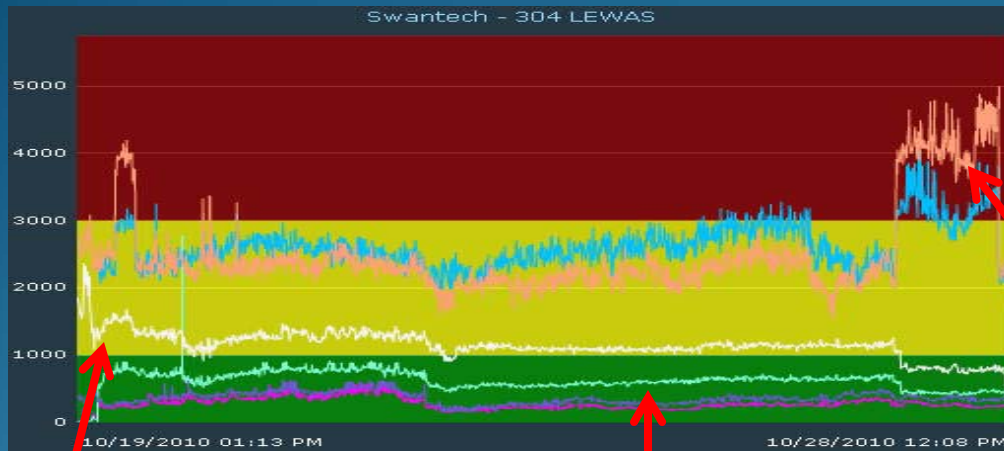
# Centrifugal Pump Analysis: Portable Unit:



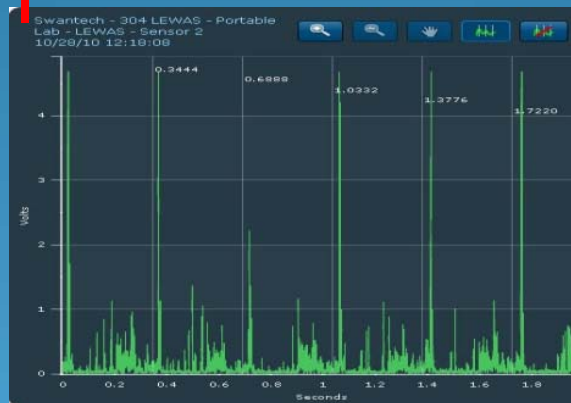
- During the initial engineering evaluation, the GPM through the pump was off the design curve to the right.
- We restricted the discharge directly off the pump to lower the GPM to 600. This brought the pump on to its design curve and dramatically reduce the SWE levels.
- The long term solution is to size an orifice to be placed further down the discharge line, while leaving the discharge valve fully open. This is suggested in the RCI power point.



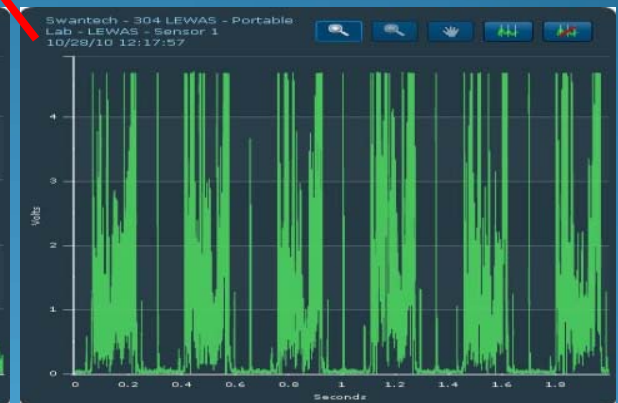
# Targeted component analysis:



**Head #3**



**Head #2**



**Head #1**

The waveform analysis takes 2 seconds of data. You can then look at specific impact events and their frequency. You will notice the clean waveforms correlate to the lower SWE levels, busier waveforms, higher SWE. You look for trend level changes, and widening of the trend.

# Wire saw bearing SWE testing:

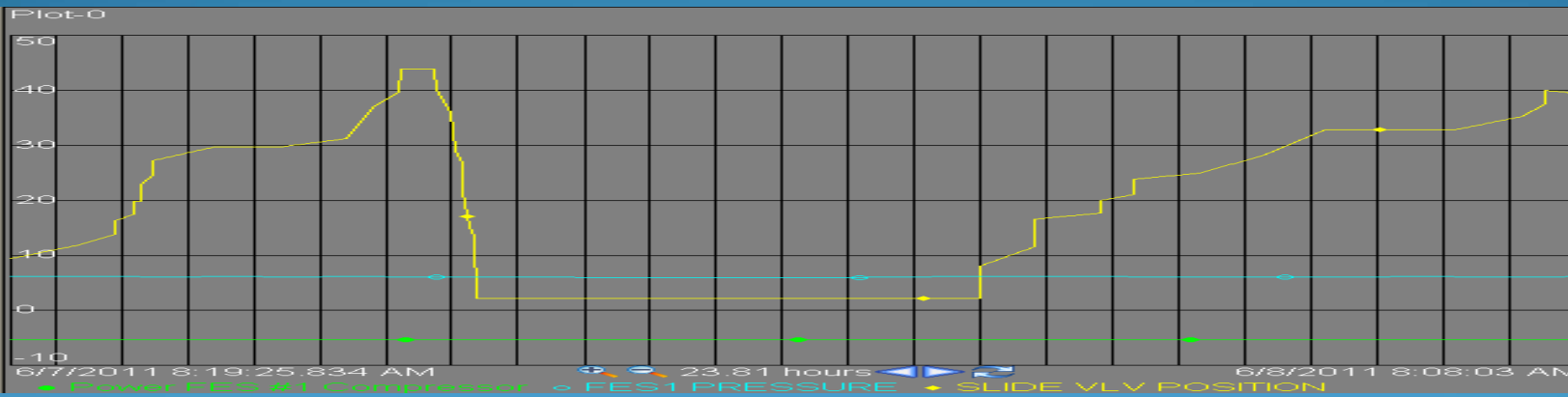
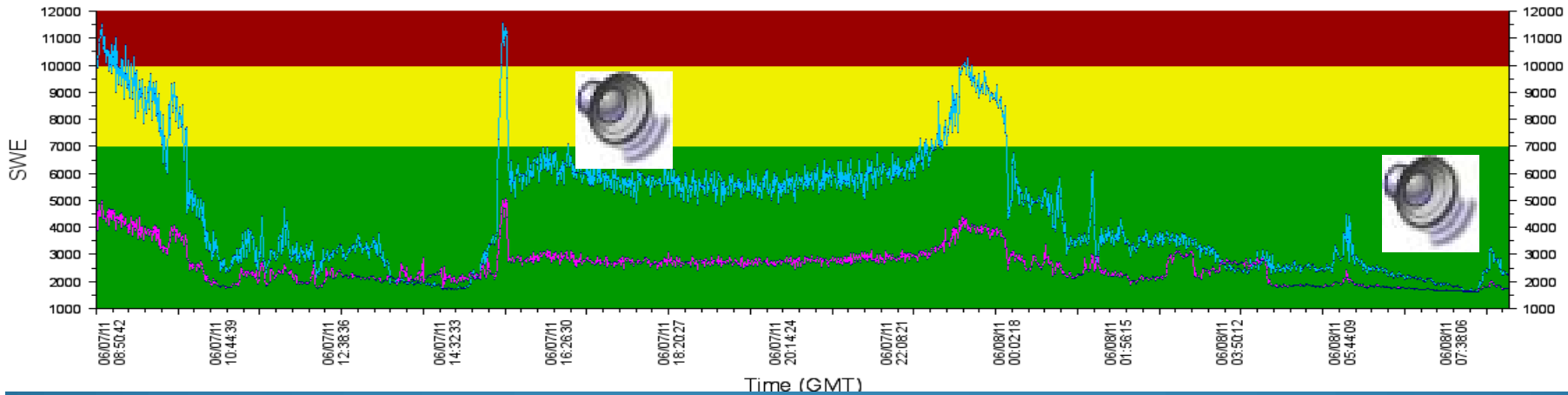


During the initial run, all bearings had approximately 20 hours of runtime. We expected all these bearings to be healthy. Bearing #4 (Light green) had a significantly higher SWE level immediately. We also inspected this bearing with ultrasound and Infrared. Both of the technologies also indicated an unhealthy condition. #4 bearing was replaced and the test repeated. All SWE levels were low and consistent.

# Chiller SWE vs. Load 6/7/2011 to 6/8/2011

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06/07/11 - 06/08/11

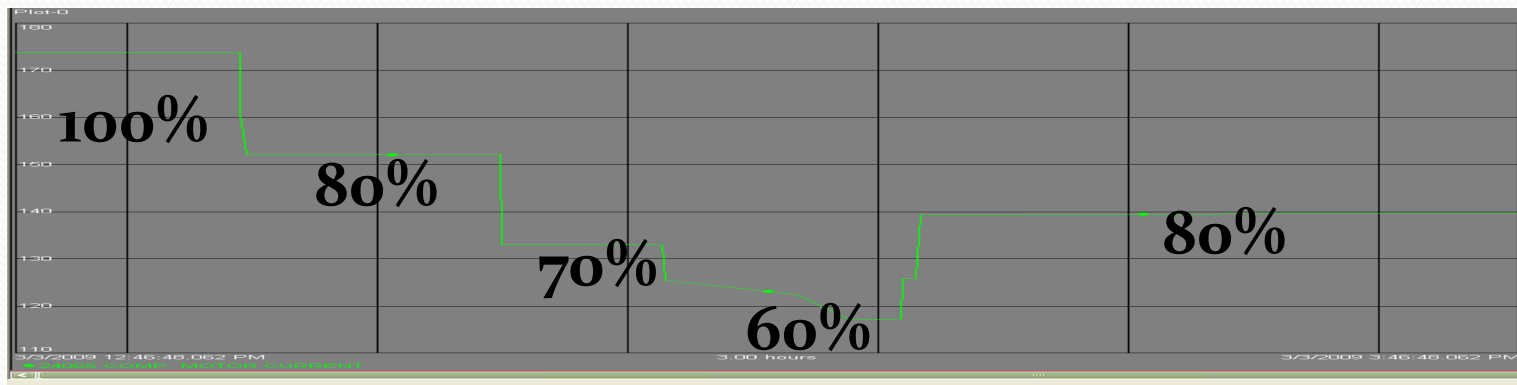
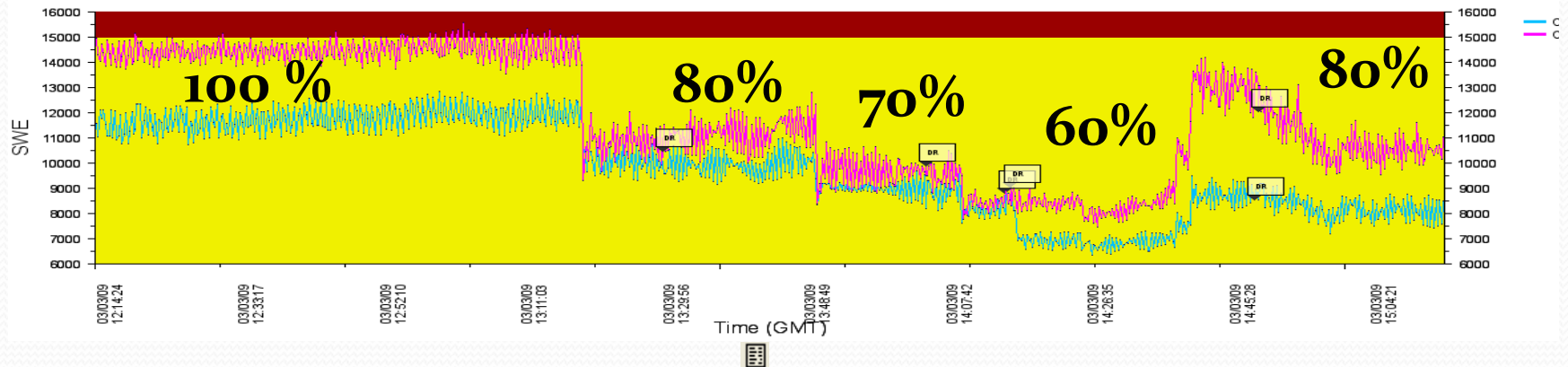


In addition to the SWE data there are also imbedded ultrasonic wave files that indicate the bearing sounds rougher under no load vs. higher load. Managing load and SWE will improve reliability on these machines.



# Energy Conservation: 1000 HP MYCOM

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03/03/09 - 03/03/09



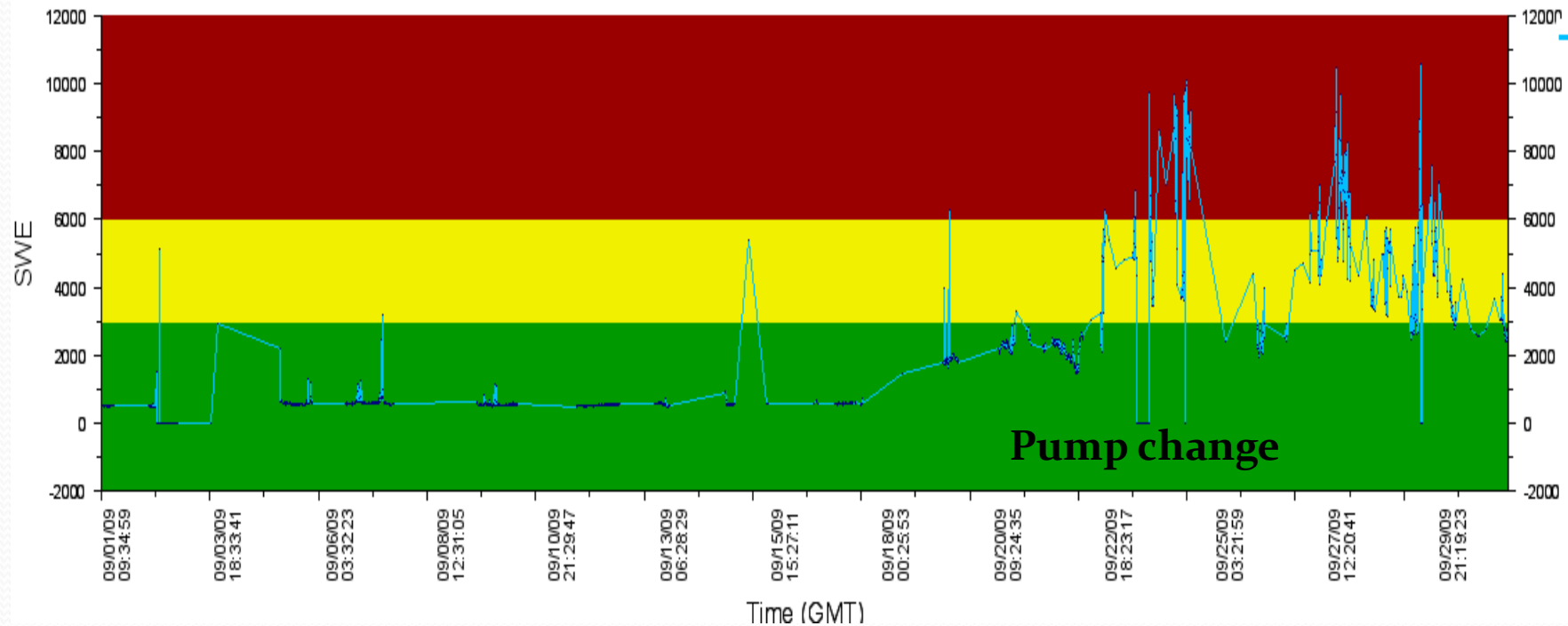
We use the SWE data to find the “Sweet Spot” Both from an equipment Reliability (Mechanical) standpoint, and from an energy conservation stand point!



# Distillation pump running with a fouled column tray .

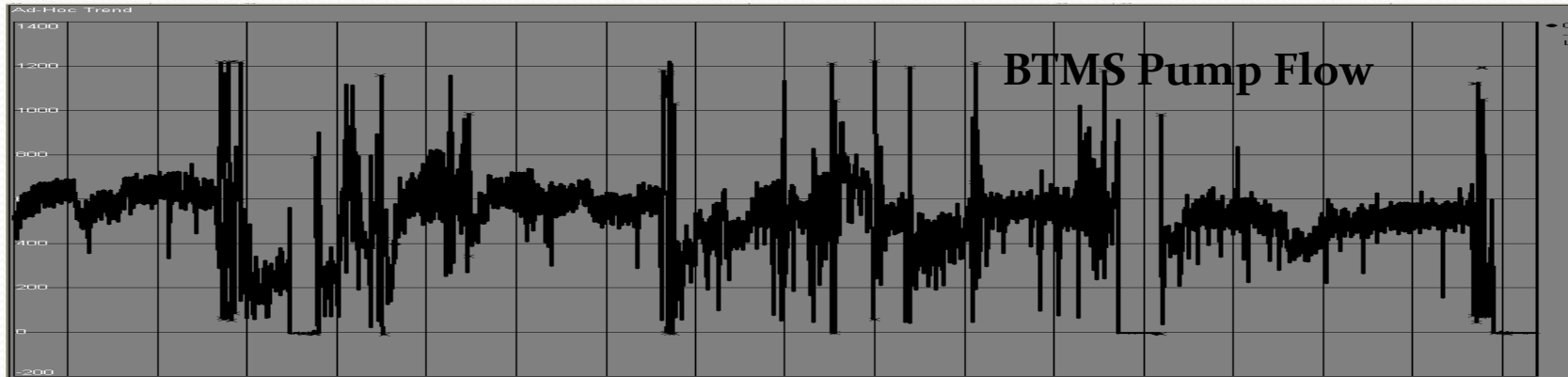
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09/01/09 - 10/01/09



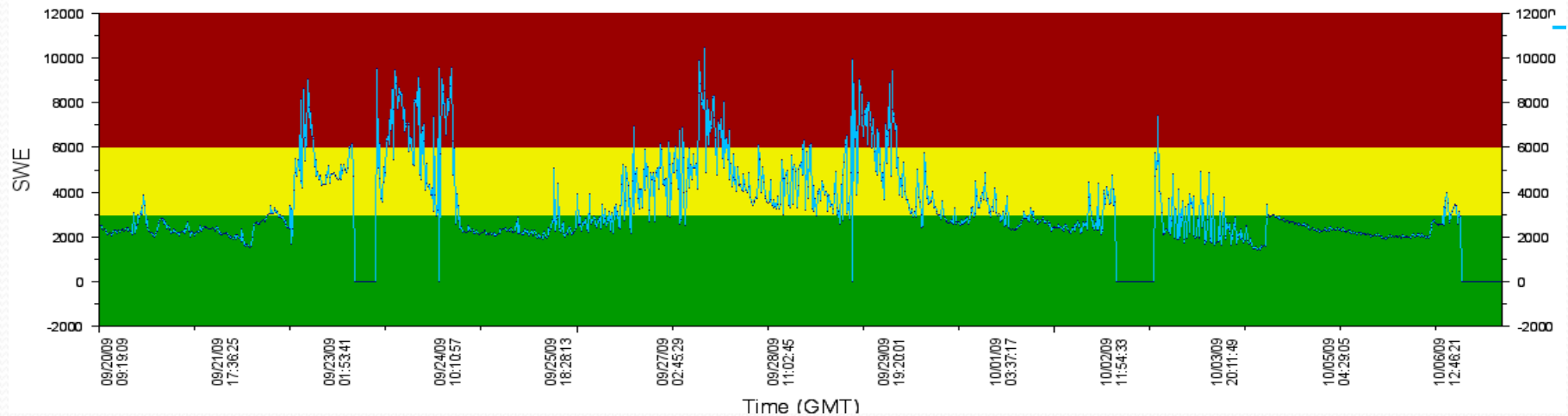
- SWE began an aggressive and erratic trend upward.
- SWAN data confirmed initial bearing wear in pump. Pump replaced.
- Pump restarted: SWE remained HIGH!
- This prompted building to further investigate the high initial SWE level.

# Erratic pump flow (Flashing)



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09/20/09 - 10/07/09



- Pump flow dropped off, as SWE elevated. Indicating the SWE was identifying “flashing” within the pump from entrained vapor.

# Questions? Summary thoughts.

- We have found great value in Stress Wave Energy (SWE) providing us the opportunity to have data driven conversations to identify and remedy root causes of machine failure.
- Compliments alternative predictive technologies.
- Scientech StressWave System Technology is very versatile: Understand operational effects, lubricant condition, and the early onset of mechanical faults.
- THANK YOU!