Smart Tools for Smarter Maintenance

Leveraging Predictive Technologies to Optimize Your Facility O&M Program

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Introduction

John Rimer, CFM

- 17+ Years Facility Management
- Numerous Industries & Various Roles
- Owner, FM360 Consulting
- Certified Facility Manager (CFM) - IFMA
- Director, Northern Rockies Chapter of IFMA
- IFMA & BOC Qualified Instructor
- PdM Experience
  - Implemented & Managed PdM Programs
  - PdM Consultant
  - Vibration Analyst Level III
  - PdM/Vibration Analysis Instructor
Agenda

- Maintenance Strategies & Definitions
- Benefits of PdM
- PdM Technologies
  - What They Are
  - What They Tell You
  - When to Use Them
- Incorporating & Integrating Technologies
- Where to Learn More
Maintenance Strategies

- Run-To-Fail (RTF)
  - Ain’t Broke, Don’t Fix It...
- Preventive Maintenance (PM)
  - Calendar/Run-Time Based
- Predictive Maintenance (PdM)
  - Data & Trend Based
- Condition-Based Maintenance (CBM)
  - Information Based – Holistic
  - Right Maintenance at the Right Time
Poll #1

What would you estimate as your scheduled (PM/PdM/CBM) to unplanned maintenance (CM/EM) ratio? (PM/CM Ratio)

- 80/20 or Better
- 50/50 or So...
- 20/80 or Worse
- I have no idea...
Benefits of PdM

Rule of 100/10/1

- 100 – People/Production
  - Increase Uptime (70%+, Fluke)
  - Schedule Downtime

- 10 – Facility
  - Reduce Maintenance Costs (25%+, Fluke)

- 1 – Utility Costs
  - Lower Energy Costs (15%-25%, MT Online)
Predictive Technologies

- Vibration Analysis
- Infrared Thermography (IR)
- UltraSound (U/S)
- Ferrography – Oil/Fluid Analysis
- Motor Circuit Analysis (MCA)
- Laser Alignment
Poll #2

Which PdM Technologies do you currently use in your facilities? (Select all that apply)

- Infrared Thermography
- Vibration Analysis
- Ultra-Sound
- Ferrography/Fluid Analysis
- Motor-Circuit Analysis
- Laser Alignment
**Vibration Analysis**

Measures vibration to identify faults and potential failure modes

- Overall Vibration
- Fast Fourier Transform (FFT)
  - Amplitude vs. Frequency
  - Velocity (in/s) and Acceleration (g)
  - RPM/Shaft Speed or Multiple of 1X
Vibration Analysis

More than Bearings...

- Unbalance
- Misalignment (Coupling/Sheaves)
- Bent Shaft
- Gear/Gearbox issues
- Looseness
- Belts
- Fan & Impeller Issues
- Electrical & Motor Issues
- Resonance & Beat Frequencies
Vibration Analysis

When to Use Vibration Analysis
- Rotating or Reciprocating Equipment
- 10HP or larger
- Critical Equipment/Systems
- Monthly to Quarterly Readings

How to Implement
- Resources
  - Tools & Software
  - Training/Certification
- In-Source vs. Out-Source
  - Overall Vibration Tester
  - Call-in Experts when Needed
Infrared Thermography (IR)

Uses infrared imaging, detecting radiation in the infrared range, to measure and visualize relative heat of objects

- "Picture is worth a thousand words"
- Identifies but does not specify
Infrared Thermography (IR)

Applications...
- Mechanical Systems
- Transformers
- Breakers
- Switches
- Envelope Testing
- Conveying
Infrared Thermography (IR)

When to Use IR
- Annual PdM
- 200A or larger
- Troubleshooting
- Selling...

How to Implement
- Resources
  - Tools & Training
- In-Source vs. Out-Source
  - In-House Camera
  - Call-in Experts when Needed
- IR Ports
UltraSound (U/S)

Acoustical analysis at the ultrasonic level - hearing things we can’t...

- Steam/Air/Gas Leaks
- Steam Traps
- Transformers
- Bearings
- Lubrication
- Cavitation
UltraSound (U/S)

Examples
- Indiana University - $300k/yr savings on ~3000 traps
- 1” pipe @10psig = $162/month

When to Use U/S
- At least Annually
- Troubleshooting

How to Implement
- In-Source vs. Out-Source
  - Size of Plant/Number of Equipment
  - Bearing Tester
Ferrography

Analyzing the particles present in fluids that indicate mechanical wear

- Oil Analysis
- Refrigerant Analysis
- Coolant Analysis
Ferrography

When to Use Ferrography
- Generators
- Chillers
- Transformers
- Gearboxes
- Transmissions

How to Implement
- Collect Samples & Submit to Lab
- Most Lubrication Suppliers have Labs
- Conducted by Service Provider
Motor Circuit Analysis (MCA)

Ascertains motor health through detection of electrical imbalances and insulation degradation

- Winding Defects
- Cable Defects
- Rotor Issues
- Integrity of Insulation
- Load Problems
- One-Time or Routine
- Online & Offline Tests
- Couple with Vibration Analysis
- Providers - Motor Shops
Laser Alignment

Aligning rotating equipment within recommended specifications

Nearly 50% of all breakdowns in rotating machines are due to misalignment (Vibralign)

- Couplings
- Belts/Pulleys
- Example
  - 14% amp draw
Incorporating & Integrating

The Whole is Greater Than the Sum of its Parts
Leveraging a CMMS for PdM/CBM
Where to Learn More

- www.reliabilityweb.com
- Maintenance Technology (www.mt-online.com)
- Society for Maintenance & Reliability Professionals (www.smrp.org)
- Uptime Magazine
- Manufacturers’ Websites
- FM360’s Online Training
Poll #3

What is the biggest obstacle to implementing a robust maintenance program?

(Select all that apply)

- Lack of management support
- Too busy firefighting
- Politics/Business relationships
- Team doesn’t see value
- Don’t need one
Questions?

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The Online Resource for Facility Industry Training & Consulting