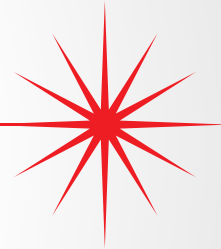


# Solutions2.0

Virtual Conference



# Upcoming CRL Workshops



**Dec. 12-15**

Co-located with IMC-2017

Bonita Springs, FL

**More information: [www.reliabilityleadership.com](http://www.reliabilityleadership.com)**



## Providers





December 11-15 | Bonita Springs, FL

<http://imc-2017.com>

# Sponsors



# Keynote

## Do You Follow a Framework for Asset Condition Monitoring?

by Dave Reiber, Senior Reliability Leader, Reliabilityweb.com



# Dave Reiber CRL / CMRP

**Currently – Senior Reliability Leader at Reliabilityweb.com**

**Recently – Global Maximo Business Lead, Predictive Maintenance Lead, and Global Maintenance Business Process Leader**



- Maximo Project Manager
- Global Maximo Business Lead
- Global Predictive Maintenance Lead
- Member of IBM Maximo Advisory Board
- Co-Lead for IBM Manufacturers User Group for Maximo
- Speaker at many Maintenance and Maximo Conferences
- Led Maintenance Webcasts for Reliabilityweb, Industry week, UE Systems, and Plant Engineering Magazine
- Member of editorial advisory board for Plant Engineering
- Hosted many Maximo & Predictive Webinars for General Motors
- Certified CRL – Certified Reliability Leader
- Certified CMRP – Certified Maintenance & Reliability Professional
- Certified – Infrared / Ultrasound
- Certified Maximo Deployment Professional

# Why use the Uptime Elements Framework?

*Because it works!*

Problem:

At large corporations and organizations, the toughest thing to accomplish, is to get everyone, from all departments, onboard and headed in a single direction.

The Uptime Elements Framework is an easy to follow roadmap that all departments can follow. Each department, or Site, can easily relate their value stream to at least one of the elements. Usually several elements can be aligned with the goals and objectives of the company, as well as the responsibilities of each group.



1. How will future maintenance assets look and act? (IIOT)
2. Do these factors significantly change how you perform operational activities?
3. What will be expected from maintenance professionals moving forward?

New tools and systems are available to provide better insight, and a path to faster and better decisions?

Significant advancements and challenges have emerged in the world of maintenance and reliability over the past few years. We are experiencing the age of the “Internet of Things, ”industrially speaking, (IIOT), where traditional methods have become ineffective or inadequate.

### **Maintenance teams are looking for:**

- Meaningful asset performance data
- Accurate predictive models
- Real-time asset health reports

## **What does the Future Reliability Leader Professional look like?**

Skilled Maintenance and Engineering support people find their place. Some will just naturally rise to greatness. Others will go through life comfortably, making a contribution, but not stepping past their comfort zone. Both types of people are needed to make things work properly, but someone has to be willing to be the person who steps outside their comfort zone, always reaching for the next level. Those who are never satisfied with the end game, but seeking where do we go next. The future Reliability Leader Professional, will have a strong imagination, willing to look past what is status quo, but seasoned with experience earned by doing the job. A person with drive for solving problems and getting better at their business

***A professional person that acts with earned knowledge of what to do and when to do it. Continuously training, learning, and certifying in their craft.***

***They know when to call for help or outside influences to assure that the integrity of the Physical Asset, Scheduled Process, and Quality are all considered before action is taken.***

***A person that is well versed in varied Maintenance Sciences. Open minded to innovation and adaptable in action plans, that support the current situation. Recognizing that all problems are not presented or solved equally.***

**The primary goal of a maintenance team should be precision maintenance, where the organization is on a flightpath of continuous improvement.**

**Specifically:**

1. More precise calls around condition failure probability
2. Available, real-time asset health scores of the most critical assets
3. Automated actions direct from the software system(s)

## Reliability Culture Supported by:

Using the Uptime Elements Chart describe where you fit in your organization;

Use a RASIC approach:


- **R**esponsibility
- **A**ccountability
- **S**upport
- **I**nformed
- **C**onsult

to understand your value stream.


# Uptime® Elements™



# The Uptime Elements as a Cultural Language:

A person in a dark suit, white shirt, and maroon tie is holding a white rectangular sign in front of their face. The sign contains the text "Do you speak Reliability?™" in a bold, black, sans-serif font. The person is wearing a watch on their left wrist. The background is a textured, blue-grey surface with a circular pattern.

**Do you speak  
Reliability?™**



The Pennsylvania Academy of Arts instructor relates this musical mastery wisdom: "So, what is the goal of a music education? I would say to "communicate" musically or in other words to **learn and to speak the "language" of music.** Using the word "language" in this context does not refer to reading the written musical language (although that is good) but instead means speaking a language in the broader sense of understanding as well as communicating the grammar, vocabulary and syntax so that "ideas" and "creativity" can be shared.

7

Putting new ideas in the same old thinking will still produce the same old results

8

New Ideas

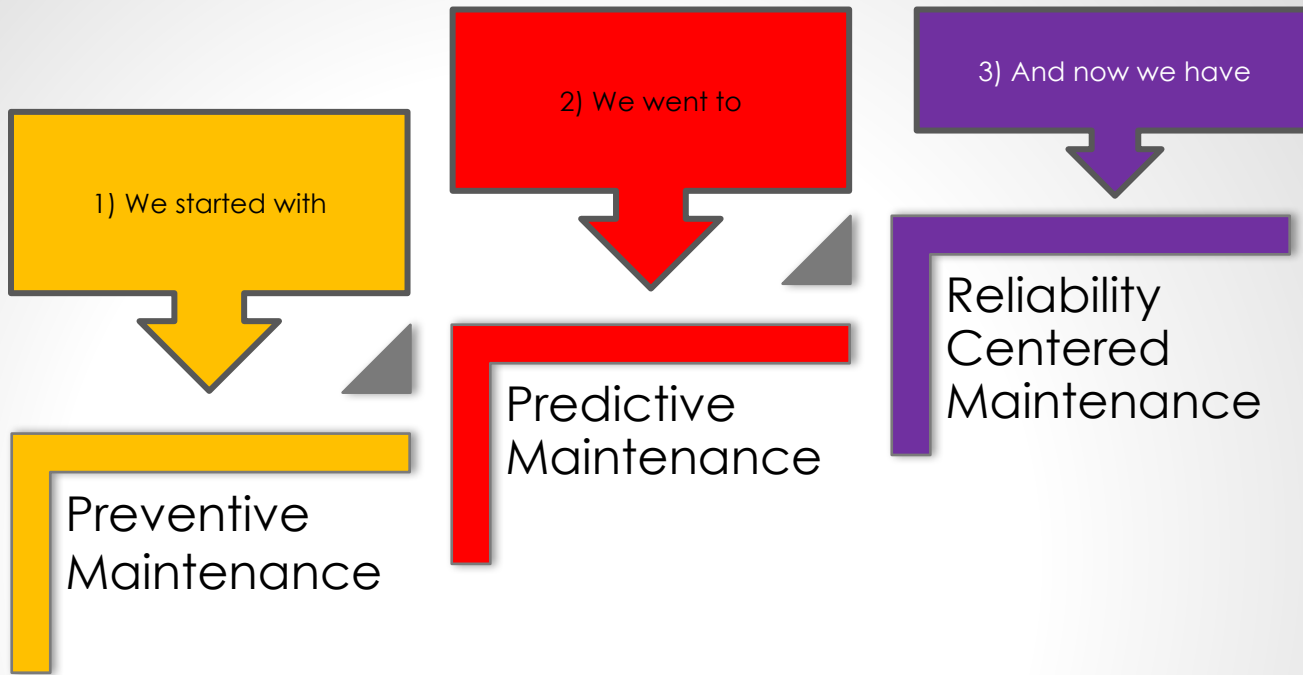


15

# Uptime® Elements™



Reprinted with permission from NetexpressUSA Inc. d/b/a Reliabilityweb.com and its affiliates. Copyright © 2016-2017. All rights reserved. No part of this graphic may be reproduced or transmitted in any form or by any means without the prior express written consent of NetexpressUSA Inc. Reliabilityweb.com®, Uptime® Elements™ and A Reliability Framework and Asset Management System™ are trademarks and registered trademarks of NetexpressUSA Inc. in the U.S. and several other countries.



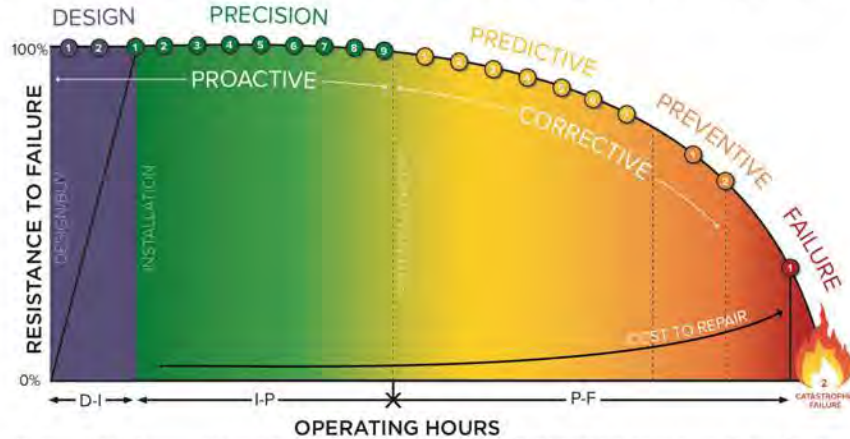
© Copyright 2017 Netexpressusa Inc. dba Reliabilityweb.com  
® All rights reserved

# HOW

# FAILURE

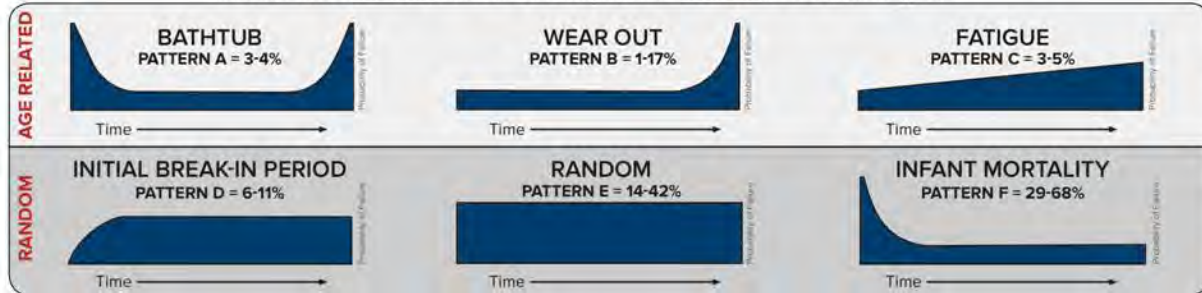
# OCCURS

## D-I-P-F CURVE (DESIGN-INSTALLATION-POTENTIAL FAILURE-FAILURE)



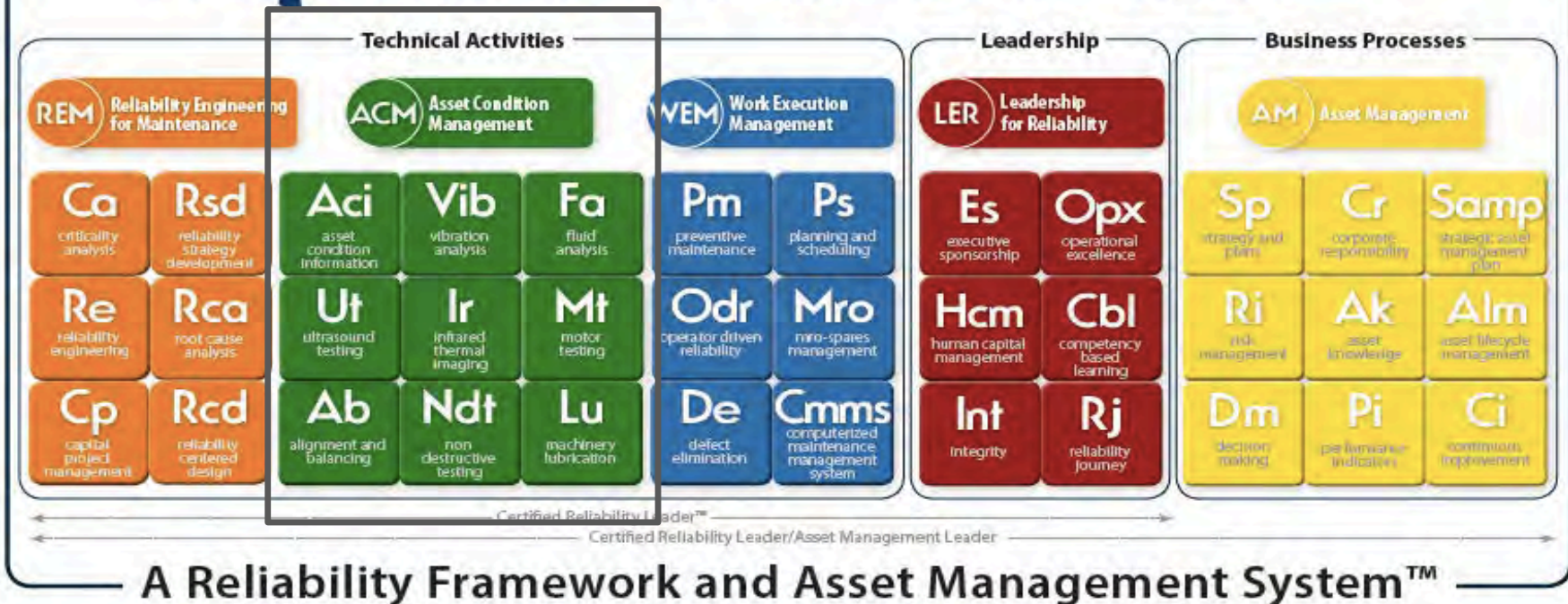
## FAILURE PATTERNS

Random failures account for 77-92% of total failures and age related failure characteristics for the remaining 8-23%.

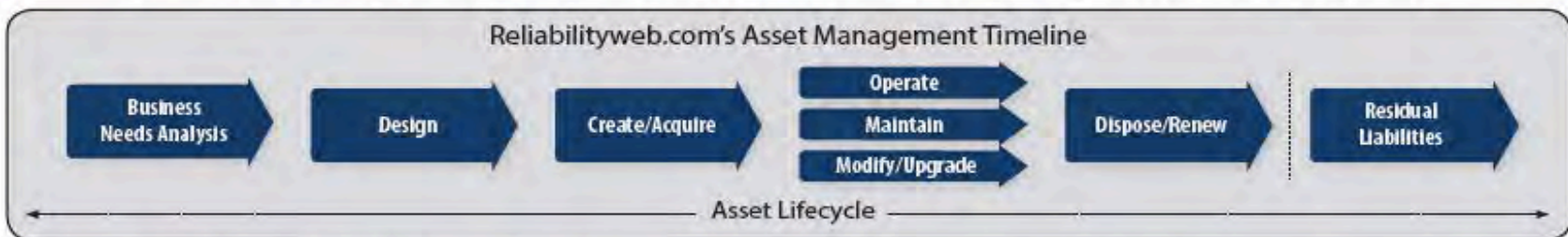


Reprinted with permission from NetexpressUSA Inc. d/b/a Reliabilityweb.com. Copyright © 2016. All rights reserved. No part of this graphic may be reproduced or transmitted in any form or by any means without the prior express written consent of NetexpressUSA Inc. Reliability™ and Reliabilityweb.com™ are trademarks and registered trademarks of NetexpressUSA Inc. in the U.S. and several other countries.

# Uptime® Elements™



### Reliabilityweb.com's Asset Management Timeline



# Why the Uptime Elements and Asset Condition Monitoring:

*The Uptime Elements is a holistic system based approach to reliability that includes:  
Technical Elements • Cultural Elements • Leadership Elements • Business Elements*

The increased use of mobile and intelligent sensor devices, along with integration of condition based analytics, and asset life cycle management, has a direct and significant impact on bottom line process improvement. Good Asset Condition Monitoring, is an important strategy, to an IIoT process that works for your organization, to optimize a better return on investment capital.

**The primary goal of a ACM Team should be more precise calls related to failure.  
The organization should be on a flightpath of continuous improvement, for data collection and data aggregation..**

## **Specifically:**

1. More precise calls around condition failure probability
2. Available, real-time asset health scores of the most critical assets
3. Automated actions direct from the software system(s)

**Aci**

asset  
condition  
information

**Vib**

vibration  
analysis

**Fa**

fluid  
analysis

**Ut**

ultrasound  
testing

**Ir**

infrared  
thermal  
imaging

**Mt**

motor  
testing

**Ab**

alignment and  
balancing

**Ndt**

non  
destructive  
testing

**Lu**

machinery  
lubrication

## Asset Condition Management Data

The ACM elements provide a visual framework.  
Easy to follow & set up to prioritize your plan for a successful implementation.

On most modern industrial assets, there are many sensors already, constantly gathering information. These sensors are giving us vital information to help us prolong the assets value to the organization.

The Uptime Elements can be referred to, throughout the ACM project. Some companies are using them as a visual roadmap, with priorities set up by your organization, and relationships to other Elements can be easily associated.

### **Example:**

*Your goal is to implement Infrared, Ultrasound, and Vibration within the next 18 months. Prioritizes are understood by everyone. Also, the association to the Hcm (Human Capital Management) and Cbl (Competency Based Learning) elements, from the Leadership domain, can help you to stay on track, with the selection of the right candidates, and the appropriate training, for a successful implementation.*

**Aci**

asset condition information

**Vib**

vibration analysis

**Fa**

fluid analysis

**Ut**

ultrasound testing

**Ir**

infrared thermal imaging

**Mt**

motor testing

**Ab**

alignment and balancing

**Ndt**

non destructive testing

**Lu**

machinery lubrication

## Asset Condition Management Data

**ACI** – All data linked to the Asset - could be found in the asset application, spare parts, histories, logs, reports, etc..

**Ut** – High frequency sound wave data for bearings, pumps, air leaks, steam systems, etc...

**Ab** – data from laser alignment & balancing work orders

**Vib** – data from vibration readings in the condition monitoring application

**Ir** – Infrared data gathered in the condition monitoring application

**Ndt** – all condition monitoring that is done non-destructing

**Fa** – data gathered from oil sampling after lab analysis

**Mt** – Condition Monitoring, routes, job plans, etc..

**Lu** –job plans, route inspections, people certifications, contractor info, etc..



Asset Condition information is all data linked to the Asset.

PM&C (Production Monitoring and Control) & Cimplicity/CMore - DATA

Failures can be:  
\*Chronic  
\*Sporadic  
\*Catastrophic  
Each need to be broken down separately

Collecting live time continuous data around Asset uptime.



Predictive Tools - DATA

Data can be very intricate and in separate systems

MAXIMO - DATA

Collecting DATA around written Work Orders related to work competed by Maintenance Team, including Emergency, Preventive, Predictive, and Projects.

People and remote Sensors collecting DATA around Vibration, Infrared, Ultrasound, etc...

**PMQ data Analytics**  
Trending, Patterning, learning, gaining intelligence around the data, to help us be more Predictive to Failures.  
The new Term is called **Precision Maintenance**



## Discussion:

1. Do a cross-functional assessment of all Assets
2. Determine the Criticality of the Assets
3. Assign the proper Criticality # to aid in Routes
4. Determine the appropriate Condition Monitoring tool(s) to maintain Reliability
5. Collect Baseline Readings
6. Develop or refer to Standards
7. Create Routes & Task instructions
8. Establish Frequency of Route
9. Establish upper and Lower parameters to maintain Reliability

# Assessment of your Assets

Develop a total Asset List for the Site

Determine Criticality of Equipment

Assign Criticality Number  
(9-7) Highly Critical  
(4-6) Critical  
(3-1) Normal  
(0) Run Failure

Determine Appropriate ACM Technology(s)

Collection of Baseline Readings

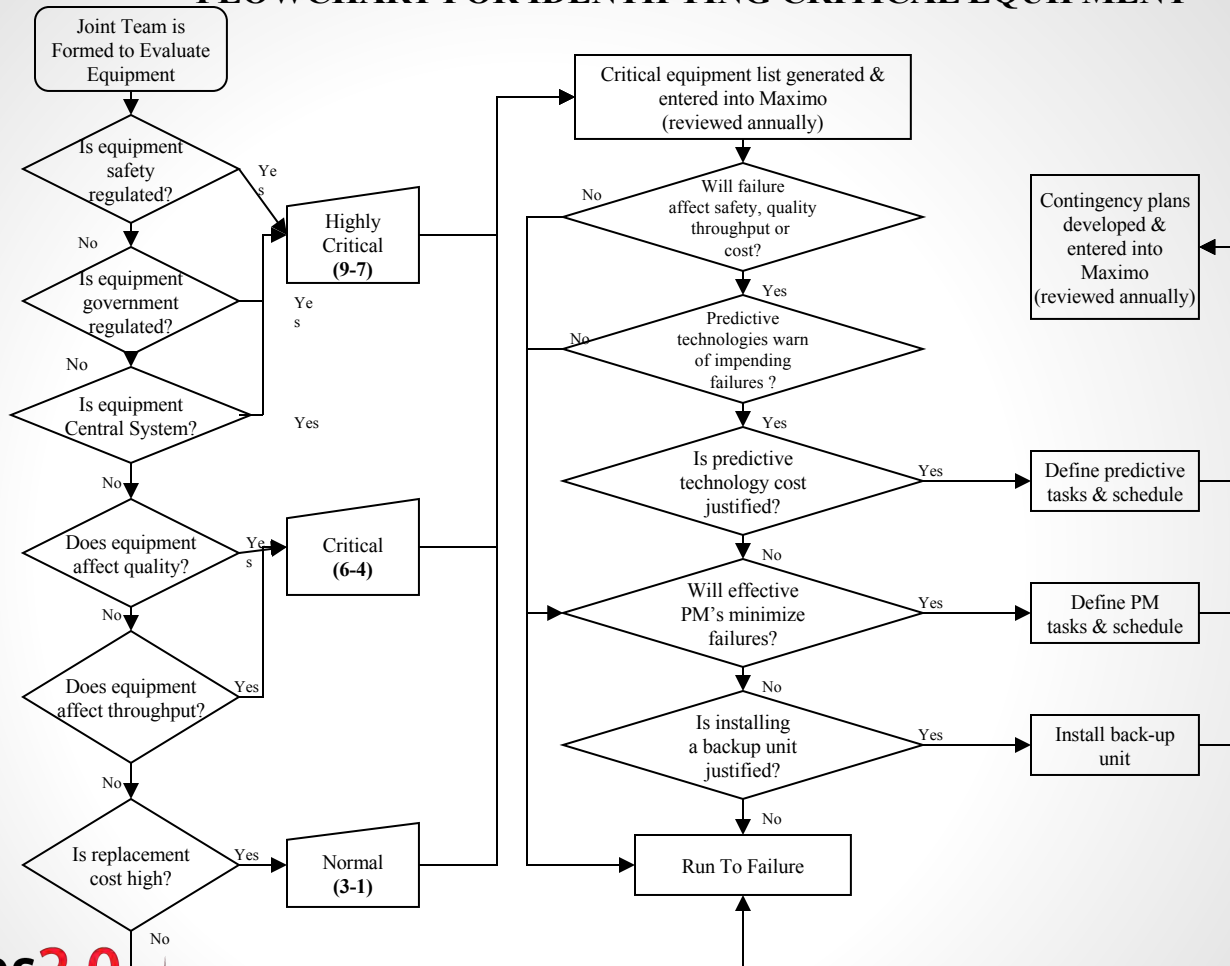
Develop Standard Procedures

Create Routes, Workorders, Task Instruction Sheets

Determine Frequency of Inspections

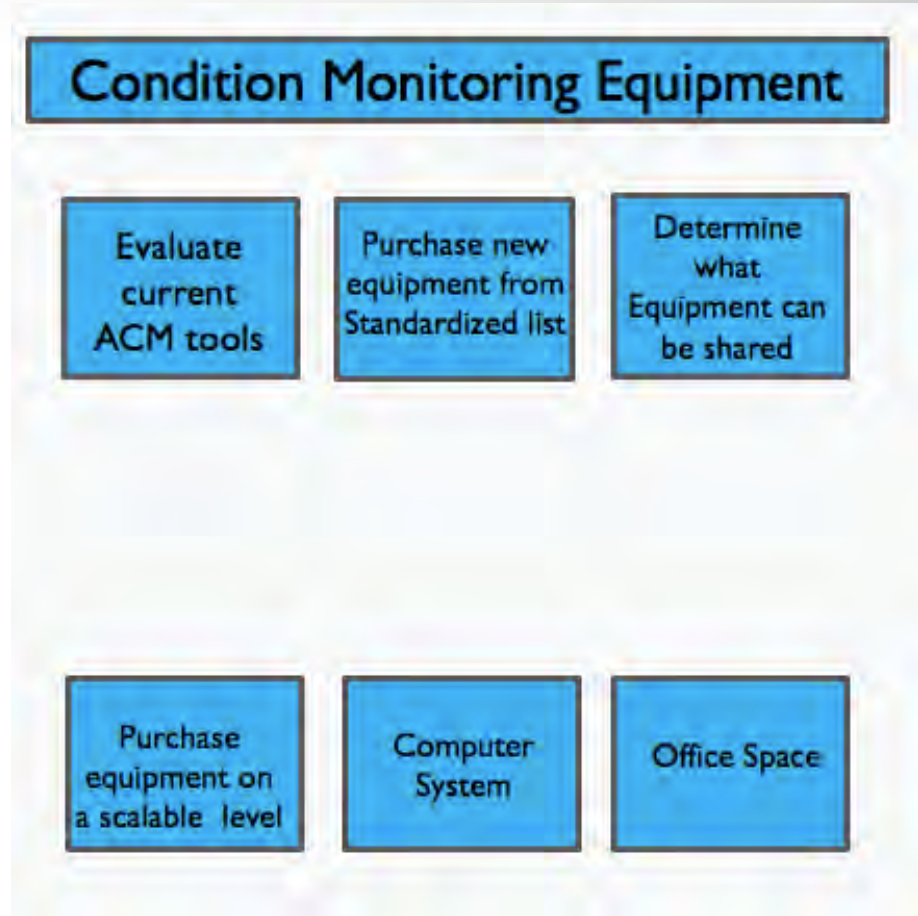
Establish Alert & Alarm Criteria

# FLOWCHART FOR IDENTIFYING CRITICAL EQUIPMENT



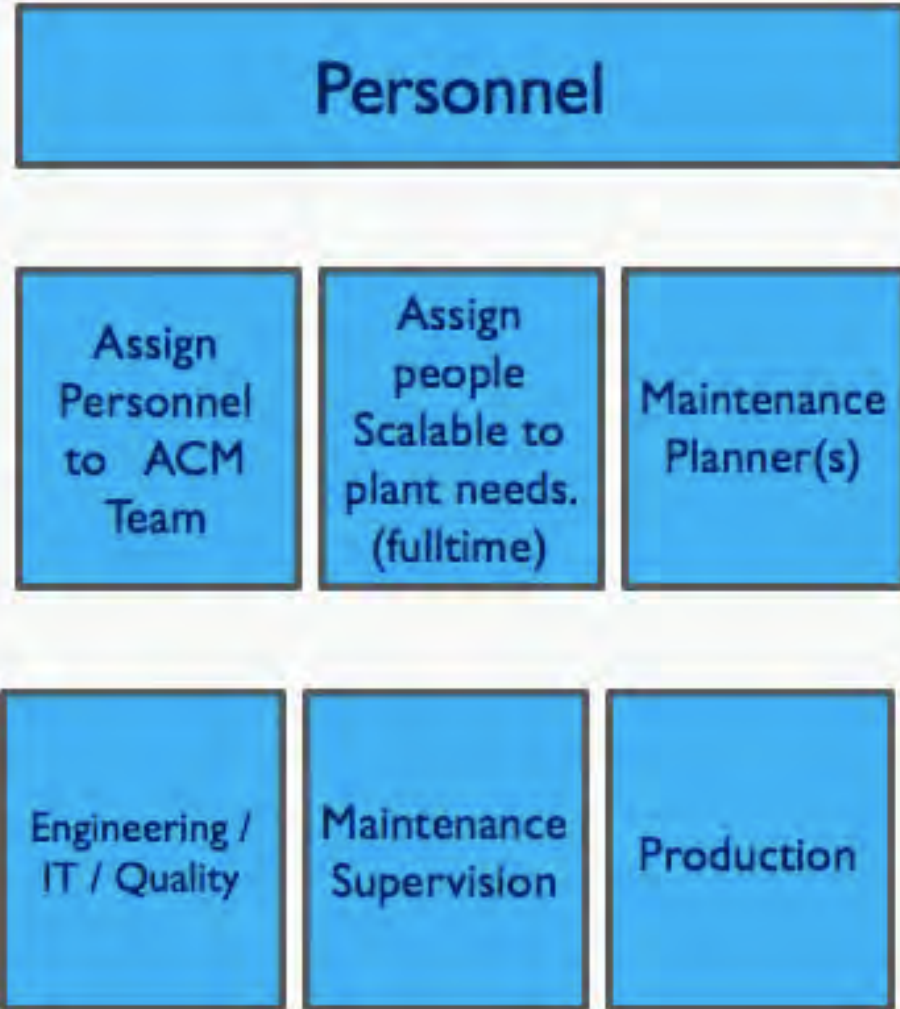
## Discussion:

1. Evaluate current ACM tools that you have and tools that you need
2. Purchase tools to work with your plan. Standardized lists can acquire better pricing and consistent training.
3. Match up these with the Uptime Elements Framework to the Project Framework
4. Purchase equipment on a scalable basis. Get some wins and talk about them, celebrate them.



## Discussion:

1. Assign proper people to the Team (Hcm)
2. Assign scalable to needs of the Site
3. Train them and the Maintenance Planners to work together in route building and frequencies.
4. Engineering, Maintenance Techs, and Condition Monitoring Techs all working together to solve the big problems
5. Attend Operations meetings to keep them in the loop



## Discussion:

1. Consistency, Quality, Credibility, decision making, WIIFM
2. Good, clean data, software class, consistency, etc..
3. Work with Established Standards
4. Have periodic meetings with your Condition Monitoring team to collaborate on problems found and problems solved.

# Training & Technical Support

Provide  
Certification  
classes

Provide  
Software  
Classes

Train plant  
Personnel  
Report  
Writing

Train Plant  
Personnel to  
properly set  
up a database

Train Plant  
Personnel to  
properly  
collect data

Establish  
Standards  
Committee(s)  
to support  
new teams

## Discussion:

1. Understand the current state in relation to Maintenance Costs – Baselines
2. Give expectations – expect Results – (ROI)
3. Do before and after Reporting
4. Calculate Cost Savings / Cost Avoidance (Discuss)
5. Audit your program for results and improvements.

# Measurements

Baseline  
Current  
Maintenance  
Cost

Show  
Return on  
Investment  
(ROI)

Document-  
ation /  
Reports

Calculate  
Cost Savings  
and Cost  
Avoidance

Establish  
costs per  
hour

Audit ACM  
Program for  
Continuous  
Improvement

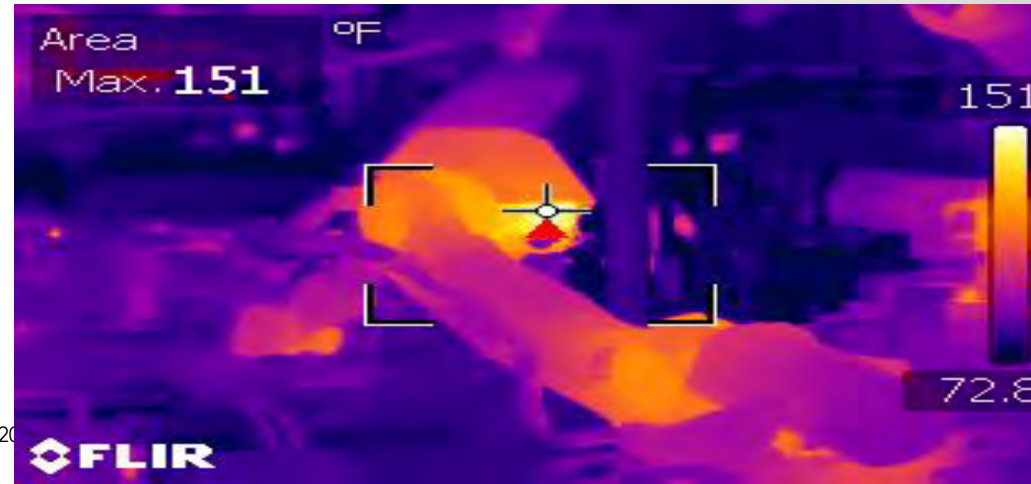
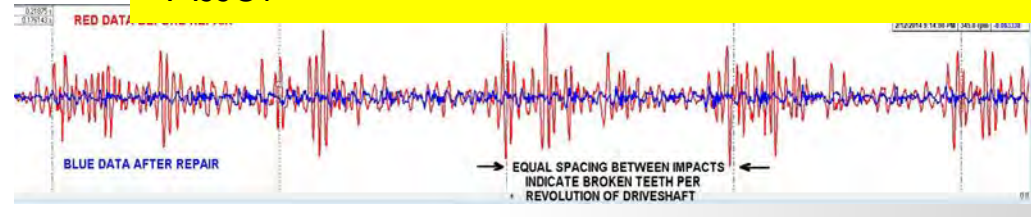
# A Closer look at the Condition Based Technologies

# Condition Based Technologies

- Vibration Analysis
- Infrared Thermography
- Ultrasound / Shaft Ultrasound
- Electrical Motor Diagnostics
- Oil Analysis / Lube Training
- Laser Alignment
- Hi-speed Video
- Video Probes
- Optivibe / Bridgeview

## Decisions around ACM Tools:

- Recognizing the ROI timeframe
- Assign the right Predictive tool(s) to the Asset



# Cost Savings / Cost Avoidance

# Definitions

- **Cost Savings**

- Dollars that are currently spent but will not be spent in the future.

- **Cost Avoidance**

- An estimated dollar amount that would be expected to be paid in the future if proactive events did not keep the machine, tooling, or system producing units

# ACM

## ASSET CONDITION MONITORING PROJECT MANAGER'S GUIDE

# AUTHORS



### Jack Nicholas, Jr.

Jack Nicholas, Jr. CRL, CMRP, has over 45 years' experience leading, teaching, training and consulting in the fields of maintenance and reliability in government, military, utility and commercial venues in Asia, Australia, North America and the Caribbean. Mr. Nicholas is author, co-author, editor and major contributor to many books, professional papers and magazine articles on maintenance reliability subjects.



### Dave Reiber

Dave Reiber, CRL, CMRP, is the Senior Reliability Leader of Reliabilityweb.com. Mr. Reiber has 20 years as a leader in enterprise asset management and asset condition monitoring as the former Global Training Lead for Enterprise Asset Management & Predictive Maintenance Business Lead for General Motors. He is a seasoned international trainer with deep experience in handling diverse cultures and languages. Mr. Reiber received a Chairman's Honor Award for Leading Team in developing global maintenance business process and a CIO award for successful Enterprise Asset Management deployment in Liuzhou, China.



### Terrence O'Hanlon

Terrence O'Hanlon, CMRP, Chief Executive Officer of Reliabilityweb.com and Publisher for Uptime® Magazine, is an asset management leader specializing in reliability and operational excellence. He is certified in Asset Management by the Institute of Asset Management and is a SMRP Certified Maintenance & Reliability Professional. Mr. O'Hanlon is a popular keynote presenter with the ability to deliver awareness about the business advantages of asset management to top management.

# Questions / Comments

Dave Reiber CRL / CMRP  
Senior Reliability Leader at  
Reliabilityweb  
Email – [dave.reliabilityweb.com](mailto:dave.reliabilityweb.com)  
Phone - 239-333-2500 - 126



Jim Hall, CRL, Executive Director  
The Ultrasound Institute, LLC  
Contributing Author: UPTIME Magazine

*Since 1988 - ULTRASOUND TRAINING...Through Experience.*

# The Ultrasound Institute (TUI)

“WE SELL NO INSTRUMENTS” we are solution provider!

The Ultrasound Institute (TUI) is a member of Mapped Services and Training (MSAT).

Ultrasound, Infrared and Vibration Analysis are complimentary technologies.

TUI takes pride in training and equipping ultrasound technicians with ultrasound familiarity...

- Ultrasound Theory
- Acoustic Lubrication
- Ultrasonic Electrical Inspections
- Energy Audits



# ULTRASOUND

1. Ultrasound can detect any gas leak?
2. Ultrasound can detect Corona?
3. Ultrasound can detect bearing anomalies before heat & vibration?
4. Ultrasound can detect a .005" leak at 5 psig at 50 feet?
5. Ultrasound unlike IR and is Line-of-Sight?

# Three Most Popular Ultrasound Applications

## Energy Audits

**Air & Steam “LEAK” audits – Your Quickest Payback or ROI**

## Acoustic Lubrication

**Member’s of Asset Management Professional (AMP) you can download a copy of...The Guidelines for Acoustic Lubrication of Electric Motors (free)**

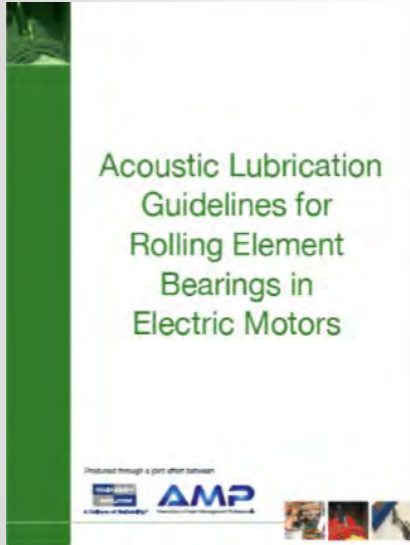
## Ultrasonic Electrical Inspection of Switchgear / Substations

**Ultrasound can be used outside the switchgear by scanning openings around doors and empty bolt holes.**

# Acoustic Lubrication

**Implementing an Acoustic Lubrication program as a condition based lubrication procedure is a “NO-BRAINER”.**

- Reduction of Man-Hours lubricating
- Cost saving by not purchasing as much lubrication
- REDUCTION of motor maintenance & failures



# Ultrasonic Electrical Inspection

- Ultrasound can detect Corona, Tracking & Arcing
- Does not require Line of Sight (unlike IR & Corona Camera's)
- Ozone, Nitric-Oxide, Carbon, Ultra-Violet Light
- Performed from outside of cabinet.
- Several Stress Cone & Insulation Failures...

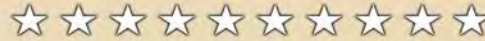


7,200V Phase to Ground & 12,470V Phase to Phase



**ULTRASONIC WAR STORIES**  
**Is Returning “early” 2018!**

# ULTRASONIC WAR STORIES



*Subscribe  
Today!*

**Become an  
Ultrasound Leader!**

Join our community to  
receive our **“FREE”**  
bi-weekly newsletter  
of Ultrasound War stories.  
Send in your war story and  
you will get an Ultrasound  
Leader T-Shirt!

[www.TheUltrasoundInstitute.com](http://www.TheUltrasoundInstitute.com)



Mister Ultrasound



- \* Heat Exchangers
- \* Condenser Leaks
- \* Acoustic Lubrication
- \* Steam Trap Troubleshooting
- \* Leak Detection
- \* Electrical Scanning

WIRAM Series Sponsor

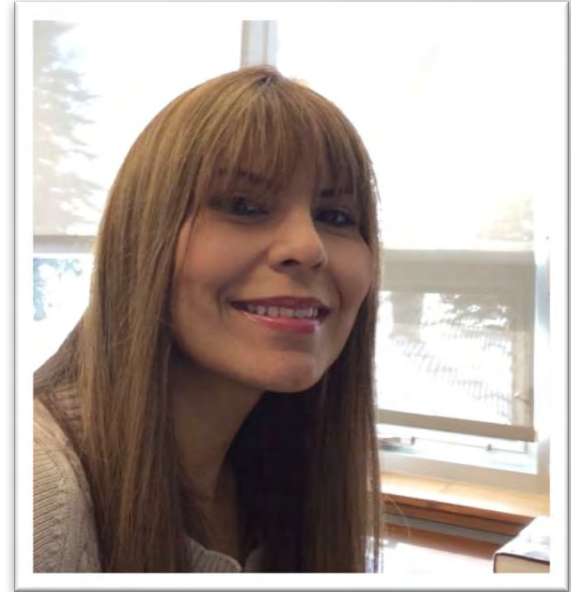


WIRAM Series



# Implementing the 5Rs to Build a World-Class Lubrication Program

by Johanna Valera, Senior  
Reliability Engineer, Inter Pipeline



# Inter Pipeline Ltd.



Inter Pipeline (IPL) is a major petroleum transportation, storage and natural gas liquids processing business based in Calgary, Alberta.

We own and operate world-class energy infrastructure assets in western Canada and Europe.

We own three major straddle plants, two offgas plants, an offgas liquids pipeline and a fractionator, all located in Alberta.

Our pipeline systems span over 7,700 kilometres in length and transport approximately 1.3 million barrels per day (b/d).



# Asset Management & Reliability Program (AMRP)



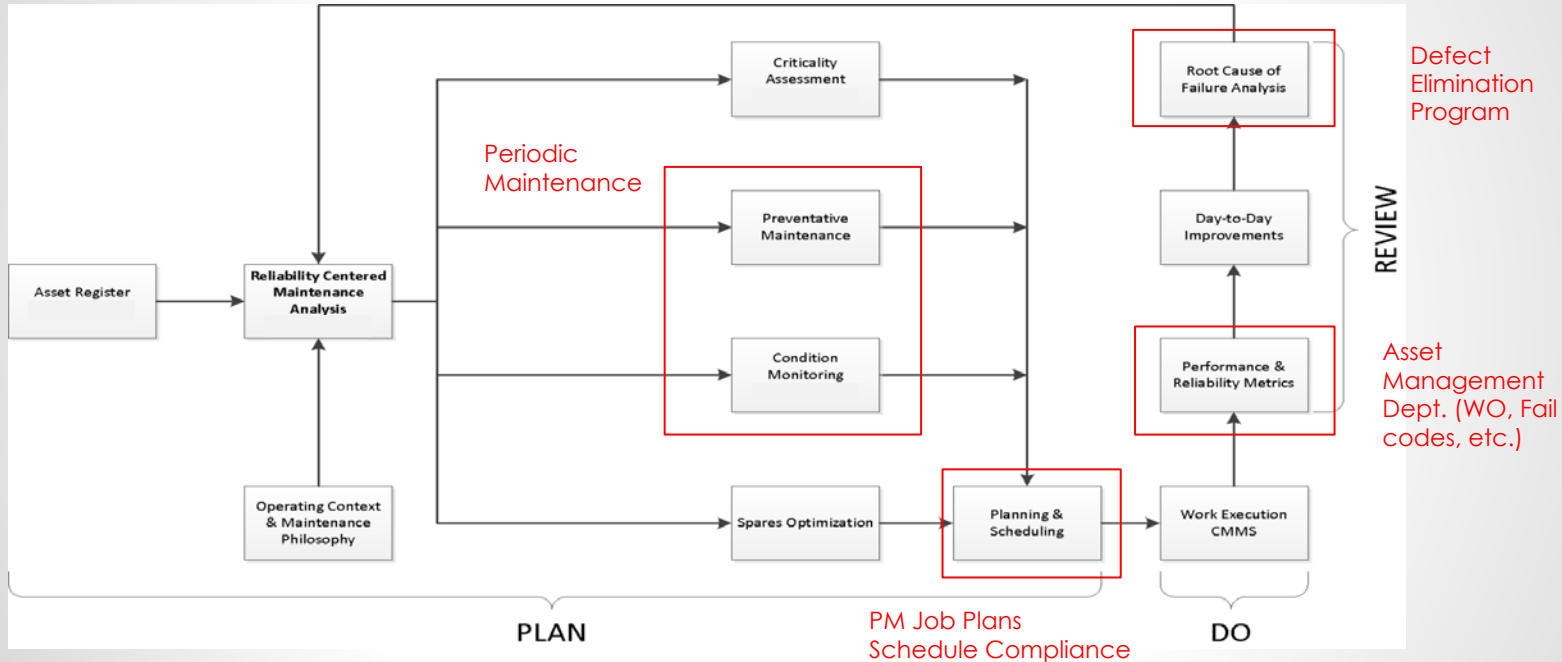
**AMRP is a formal asset management and reliability program for Canadian operations to prevent losses, improve asset reliability and maintenance effectiveness. AMRP provides an all encompassing solution to scheduling & planning, maintenance, inventory, management of change, and incident reporting.**

**One objective of AMRP is to implement standardized best practices, processes and solutions across Pipelines and NGL Extraction.**

# IPL Asset management Roadmap



The flow chart outlines a strategy focused on providing continuous improvement

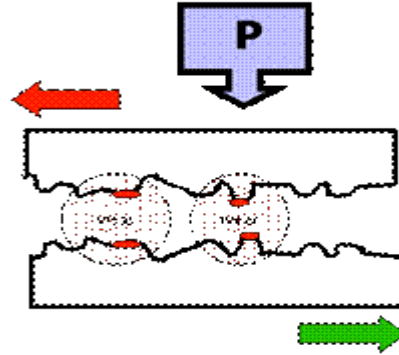


# Tribology & Lubrication

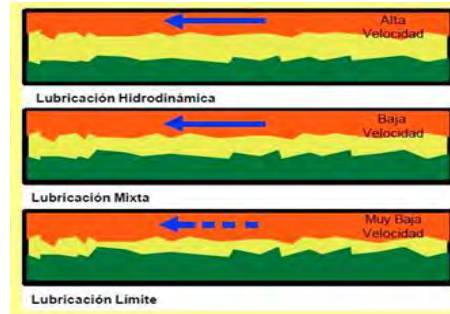


The word tribology comes from the Greek -tribō, "I rub", and suffix -logy from logia "study of", "knowledge of".

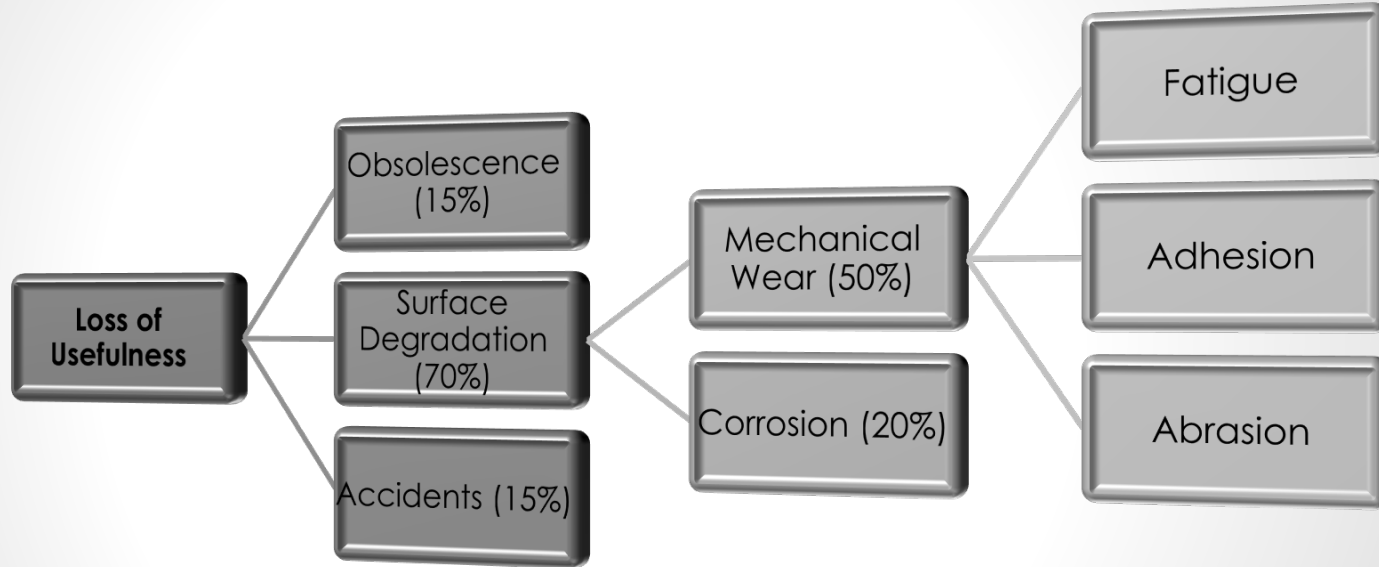
Is the science that studies the friction, the wear and the lubrication that take place during the contact between solid surfaces in movement



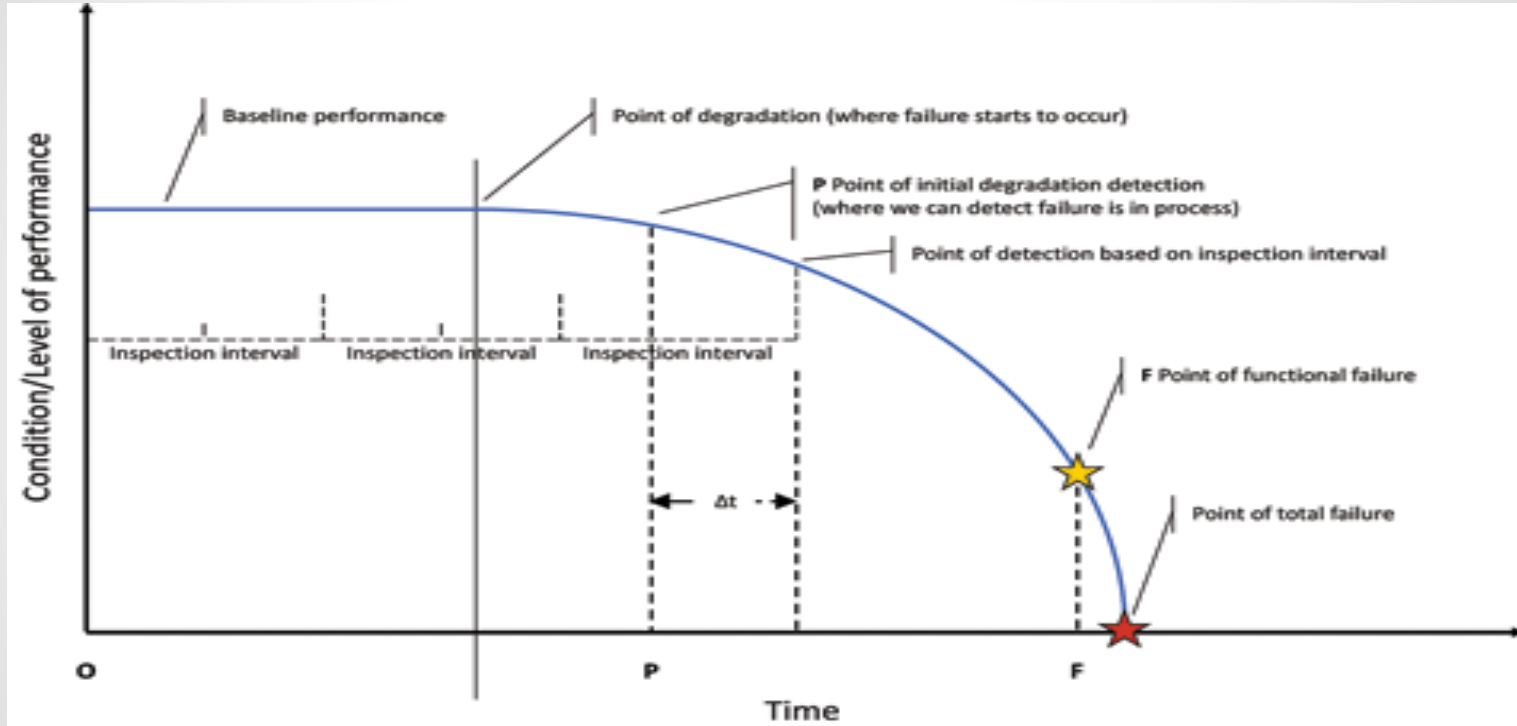
The lubrication is used to reduce the friction between, and wear of one or both, surfaces in proximity and moving relative to each other, by interposing a substance called a lubricant in between them



# Equipment life & Lubrication

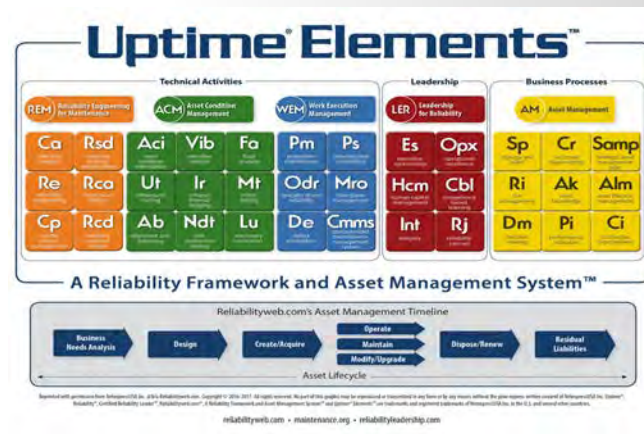


# Equipment life & Lubrication



# Implementation of the Lubrication program – Steps to success

- Development of the Lubrication Program (Benchmark Performance)
- Implementation of the Lubrication Program
- Lubrication Program Management
- Lubrication Program Improvement



# Implementation of the Lubrication program – Steps to success

**Step 1: Benchmark Performance** - Define the scope and criteria, set goals and priorities, and benchmark current performance to best practice.

**Step 2: Define Opportunities** -These opportunities may relate to PM scope optimization, failure prevention, failure severity minimization, and work planning and energy efficiency.

**Step 3: Design Best Practice** - Create the blueprint for oil analysis inspection, lubricant selection, lubrication procedures, contamination control, training and skills management, and metrics.

**Step 4: Implement Best Practice** - Ensure awareness and communication to stakeholders, equipment modifications, auditing/testing, and continuous improvement.

# Lubrication Benchmark assessment



Recognize and promote the importance of a well-designed lubrication program



<b>Customer Information</b> INTER PIPELINE COCHRANE IMPORTS GATE 227145, RR45 COCHRANE, ALBERTA T4C2B Attention : : 2046 NINA VALFRA Phone # : : (403) 932-8528 Fax : : (403) 932-8530	<b>Unit Information</b> Unit #: : 0-590C - NGI Pipeline Inj Pump Component : PUMP Location : Manufacturer : SULLZER BENGHAM Serial #: : Model : 3000S C-MD Site location :	<b>Lubricant</b> Manufacturer : PETRO CANADA Brand : SPINDORO SWE Grade : 32	<b>FLUID &amp; LIFE</b> EQUIPMENT RELIABILITY SERVICES  <b>Oil Analysis Audit</b> 3121 - 48 Street, Edmonton Alberta, Canada, T6B 2W4 Phone: 877 962 3623 Web: www.fluidlife.com
<b>Sample Point Recommendations</b> ⚠️ Install Desiccant Breather with Pitot Tube into Oil Bath		<b>Equipment Photos</b> 	
<b>Sampling Procedure Recommendations</b> ⚠️ <ol style="list-style-type: none"> <li>1. Take sample under normal operating conditions when possible or immediately after shutting unit down. That will ensure a homogenous sample of hot flowing oil.</li> <li>2. Wipe excess contamination from area around the sample valve. Attach a sample port adapter to the vacuum pump. Thread the port adapter onto the sample valve until the valve is opened and the adapter is closely secured on the sample valve.</li> <li>3. Before collecting the sample, vacuum, then discard the first 150 ml (5 oz) of oil to remove any debris from the valve.</li> <li>4. As the oil level in the jar nears the top, loose the port adapter stop the flow. Avoid overfilling the sample jar. Fill sample jar top above the fill line (i.e. below the threads of the jar. Seal the jar tightly, wipe clean.</li> <li>5. Pre-label or label sample jar immediately after filling to avoid mix-ups. Make sure jars are labelled with full sample details (i.e. unit number, component type, date, kilometers/service hours on unit) (component, oil type and grade, repair/service during drain interval, oil changed Y/N).</li> <li>6. Ship the sample to the appropriate Fluid Life location immediately. Do not stockpile samples for shipping.</li> </ol>			
<b>Testing Recommendations</b> REF1 - Every 3 Months			
Key: ⚠️ Immediate Attention    ⚡ Action Suggested    🟢 No Issues Found			

# Implementing The Five Rights of Lubrication (5R's)



## Lubrication basics – The 5 R's

The **Right** lubricant

In the **Right** quantity

At the **Right** time

At the **Right** point

With the **Right** method



# 1R “The Right lubricant”

Lu

## Selecting the right lubricant

- Operating conditions
- Manufacturer's recommendations
- Lubricant supplier
- Lubricant Specification (correct viscosity and additives)
- Special Applications
- Consolidate Lubricants (If applicable)



## 2R “The Right quantity” – “More is not better”

### 3R “The Right time”

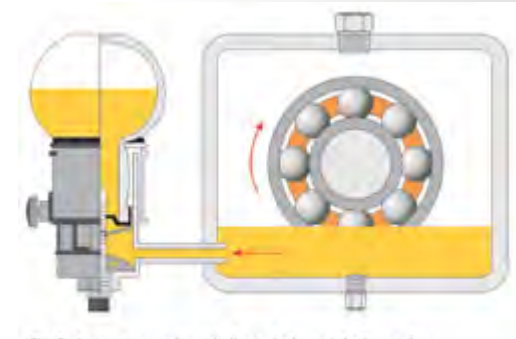


#### Grease:

- **Manufacturer's recommendations (OEM)**
- **Calculate and Adjust to maximize based on application context and environment**
- **Use of calibrated grease guns**
- **Proper lubrication intervals**
- **Condition-Based Lubrication Using Ultrasound Technology**

#### Oil:

- **Type of Lubrication**
- **Oil Levels**
- **condition of the oil (oil analysis)**



# 2R “The Right quantity” – “More is not better”

## 3R “The Right time”

**SKF Bearing Calculator**

Enter input parameters

Unit system: SI (Imperial)

Selected calculations: Bearing life, Relubrication intervals

Bearing life, Relubrication intervals

Select bearing internal radial clearance: radial internal clearance

Radial load  $F_r$ : 9.75 kN

Axial load  $F_a$ : 0.975 kN

Rotational speed of the inner ring  $n_i$ : 1800 r/min

Rotating ring: Inner ring rotation

Shaft orientation: Vertical shaft

Operating temperature: 56 °C

Calculate

Relubrication intervals : 6313

Input parameters

$F_r$  Radial load: 9.75 kN

$F_a$  Axial load: 0.975 kN

$n_i$  Rotational speed of the inner ring: 3600 r/min

Rotating ring: Inner ring rotation

Shaft orientation: Vertical shaft

Operating temperature: 56 °C

Bearing data

Designation: 6208-C3

$d$ : 40 mm

$D$ : 80 mm

$B$ : 18 mm

$C$ : 32.5 kN

$C_a$ : 19 kN

Type: Deep groove ball bearing

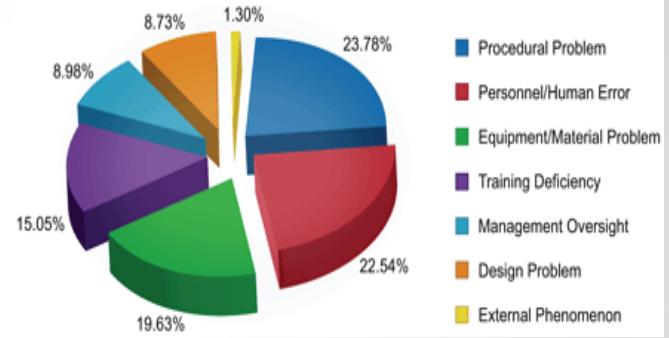
Result

Orientation	RPM	Motor DE Bearing	Motor NDE	Casing Temp. (Cels) [generally add 10 for bearing temp]	Grease Amount DE (g)	Interval DE (h)	SKF DE Rating Life (h)	Grease Amount NDE (g)	Interval NDE (h)	SKF NDE Rating Life (h)
H	1800	40BC02XP3 or 6208ZC3	40BC02XP3 or 6208ZC3	50 (341A), 35 (341D)	7	16500	32200	7	16500	32200
H	1800	40BC02XP3 or 6208ZC3	25BC02XP3 or 6205ZC3	52	7	15100	32200	4	18700	12200
H	1800	6308ZZ	6306ZZ	35	NA	NA	58800	NA	NA	41100
H	3600	6313-C3	6313-C3	38	23	4800	37300	23	4800	37300
V	3375	6316	6318	54	33	1180	50800	41	890	61200
H	1181	6316	6318	36	33	16700	145100	41	15100	174900

# 4R “The Right point”



- Identify the lubrication points
- Critical equipment and backup equipment
- Bad actors
- Detailed mapping of lubrication points
- All lubrication points must be labeled
- Train personnel on correctly adding lubricants to equipment
- Separate containers for different lubricant types
- Containers properly tagged



# 5R “The Right method”

Lu

- **Criticality analysis**
- **Define maintenance strategies**
- **Roadmaps**
- **Automatic lubrication**
- **Condition-Based Lubrication Using Ultrasound Technology**



# Continuous Improvement

myLab

Home > Browse Samples > COCHRANE EMPRESS V PARTNERSHIP > D-480 > COMPRESSORLABLAB

Customer Information

Unit Information

Lubricant

Sample Information

Unit #:   
 Component:   
 Location:   
 Manufacturer: MAPLA-TRENCH   
 Serial #:   
 Model:

Manufacturer: PETRO-CANADA   
 Brand: TURBOFLD R80   
 Grade: 68

Sample #: 2017/07/31-849   
 Sample Date: 2017/07/27   
 Lab Tracking #: 3-1177257   
 Your Tracking #:   
 Release Date: 2017/07/31   
 Version: 1

Sample Rank

2.0

Normal 0-5 Elevated 5-8 High 8-9

Sample Date	Additives											Physical Tests									
	Copper (Cu)	Lead (Pb)	Tin (Sn)	Chromium (Cr)	Nickel (Ni)	Titanium (Ti)	Silver (Ag)	Vanadium (V)	Antimony (Sb)	Beryllium (Be)	Calcium (Ca)	Zinc (Zn)	Phosphorus (P)	Magnesium (Mg)	Molybdenum (Mo)	Boron (B)	Barium (Ba)	Lithium (Li)	Visc 40°C cSt	Visc 150°C cSt	Visc Index
2012/05/07	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	65.4	8.55	102
2017/07/27	0	0	0	0	0	0	0	0	0	0	0	1	3	3	0	0	0	0	68.5	8.89	108
2017/07/17	0	0	0	0	0	0	0	0	0	0	3	4	0	0	0	0	1	0	64.0	8.30	99
2017/05/16	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0	0	0	0	68.5	8.89	108
2017/05/02	0	0	0	0	0	0	0	0	0	0	1	8	0	0	0	0	0	0	65.8	8.30	99
2017/04/02	0	0	0	0	0	0	0	0	0	0	1	2	0	1	0	0	0	0	65.9	8.64	107
2017/01/16	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	4	0	0	63.1	8.36	101
2016/12/21	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0	0	0	0	65.2	8.31	100

Lab Comments: Top Trends Analysis Correlations Reliability Alerts Discuss Graph

Results: 2017/07/27 Assuming normal oil service life, tested oil and contaminants are within acceptable limits.

Recommendations: 2017/07/27 Recanned next interval to monitor.

myLab

Dashboard Graphs

Dashboard graphs are updated nightly.

Program Health Reliability Alerts ROI Alert Turnaround Maintenance Task Scheduling Custom 1 Custom 2

Reset Filters Print

Dashboard for 2017/04 to 2017/08, by date.

Alarmed Components %

Category	Critical	Caution	Normal
Sample 1	0	0	100
Sample 2	5	15	80
Sample 3	10	20	70

Problems %

Category	Severe Reportable	Unacceptable
Sample 1	0	15
Sample 2	10	25

Ranked Samples %

Category	Very High	High	Elevated
Sample 1	0	0	100
Sample 2	10	10	80

Samples

Category	Samples
Sample 1	32
Sample 2	21

Missing Info %

Category	Missing
Sample 1	100
Sample 2	100

Turnaround

Category	Lab Analysis	Transit
Sample 1	10	5
Sample 2	10	5
Sample 3	10	10



**QUESTIONS?**

Thanks to Our WIRAM Series Sponsor



# Questions & Answers



# Thanks to Our Sponsors



# Next Webinar

**Date:** Wednesday, November 15

# Keynote

by SDT

# Educational Session

by Joseph Paris, Chairman,  
XONITEK; Founder, Operational  
Excellence Society

We'd love to hear your feedback!  
Email your questions or comments to  
[sean@reliabilityweb.com](mailto:sean@reliabilityweb.com)

Thank You  
for Joining Us!