



1



2

Presentation of a successful experience, case study, or project.

In the Brújula Session, you will learn from the shared experience of a successful implementation that will serve as a guide to initiate or improve your own plans.

Solve problems and improve your reliability through the implementation of new methodologies and technologies, understanding the origin, analysis, action plan, step-by-step process, achievements, setbacks, and lessons learned that culminate in the business case.



BRÚJULA



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Battle Tested Steps to Getting Lubrication Right!

Jim Fitch

Noria Corporation

3



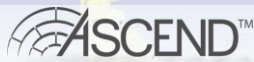
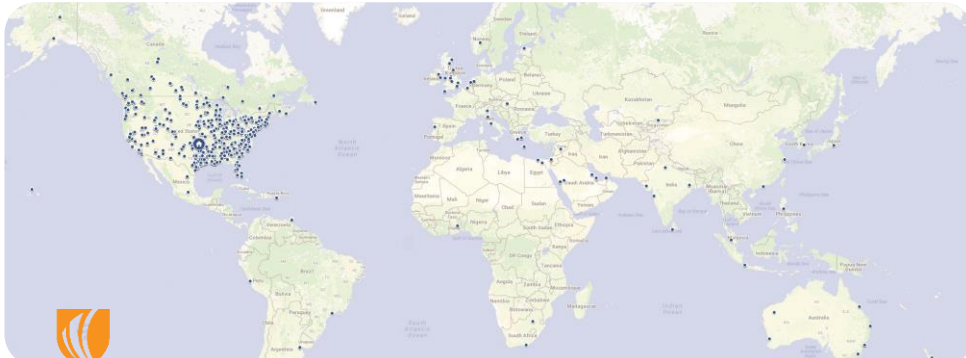
*For 25 Years, Global Provider of Machinery Lubrication and Oil
Analysis Education, Consulting, Publishing and Events.*



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- International Partners • 40+ Countries • 11 Languages
- 200+ Public Training Locations Annually
- 30+ Different Countries Attend Reliable Plant Conference
- Over 100,000 people Trained
- This is our 25th Conference Year, Orlando, August
- 1000+ Lubrication Program Development (LPD) Projects



4

Noria was Founded on the Premise that ...

- Maintenance is the No. 1 most controllable expenditure in a plant
- Every plant has a hidden plant that must be found
- Lubrication is the No. 1 cause of machine wear and failure
- There is no greater influence on the state of lubrication than training and human behavior
- All progress depends on change and change must be enabled

5

Someone Once Told Me Reliability was
about **80% Culture**
and **20% Everything Else**

6

ICML 55, an Asset Management Standard that Gets Lubrication Right

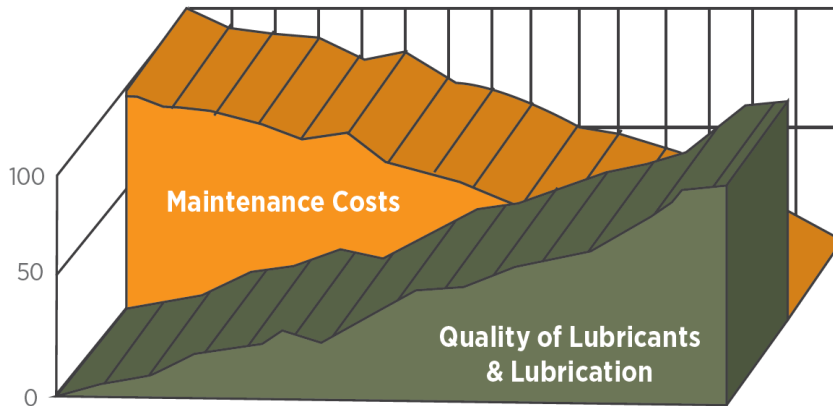
- Tactical, lubrication-specific standard, aligns to ISO 55000
- Consensus product of 48 worldwide experts
- Categorizes 12 interrelated areas to be incorporated into any sustainable lubrication program.



The Big Twelve: Interrelated Areas to be Incorporated into any Sustainable Lubrication Program
Skills: Job Task, Training, and Competency
Machine: Machine Lubrication and Condition Monitoring Readiness
Lubricant: Lubricant System Design and Selection
Lubrication: Planned and Corrective Maintenance Tasks
Tools: Lubrication Support Facilities and Tools
Inspection: Machine and Lubricant Inspection
Lubricant Analysis: Condition Monitoring and Lubrication Analysis
Troubleshoot: Fault/Failure Troubleshooting and RCA
Waste: Lubricant Waste Handling and Management
Energy: Energy Conservation and Environmental Impact
Reclaim: Oil Reclamation and System Decontamination
Management: Program Management and Metrics

7

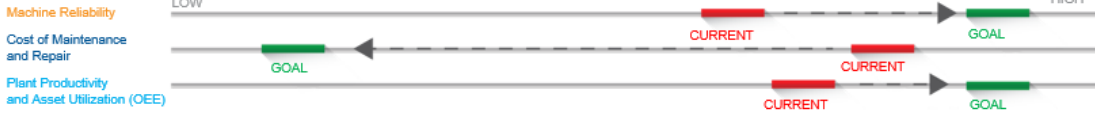
Cause and Effect



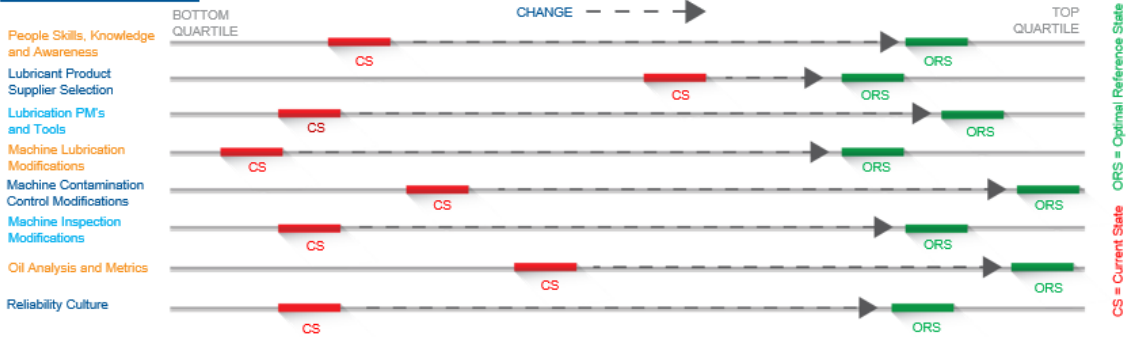
8

The Rewards of Action and Change

What You Want

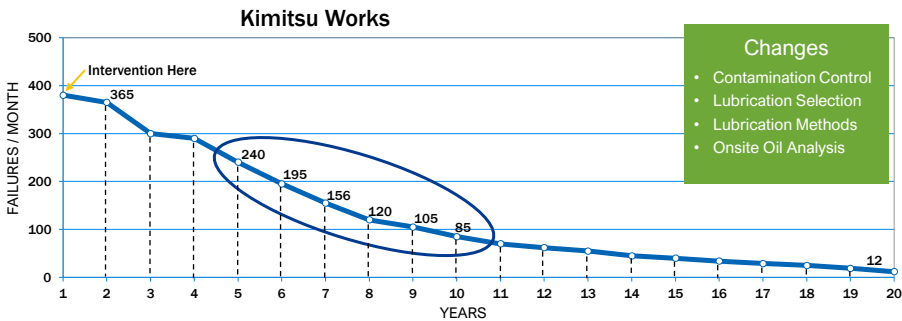


How You Get It

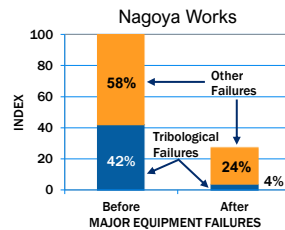


9

Nippon Steel: Test Case



- Kimitsu Works achieved a 65% bearing failure rate reduction in a six-year time period
- Nagoya Works achieved 90% reduction in wear-related failures
- Principle Strategy - improved lubrication
- Kimitsu Works - winner of the Total Productive Maintenance (TPM) Excellence prize



10



The Optimum Reference State... Defined

The **Optimum Reference State** is the prescribed optimum state of machine configuration, conditions and maintenance activities required to achieve and sustain reliability objectives. It needs to be precise, definable, measurable or verifiable. Vagueness doesn't work. Finally, it needs to be controllable,

Example Lubrication Reference States:

People Preparedness: training (good), certification (better) and skills standards (better)

Machine Preparedness: inspection, lubrication, contamination control, oil sampling instrumentation

Precision Lubricants: (what you buy) base oil type, viscosity, additives, performance properties

Precision Lubrication: (what you do) procedure, frequency, amount, location

Oil Analysis (health): lab selection, test slate, frequency, alarms, troubleshooting



The ORS is an engineering specification for lubrication excellence.

05422 Ref:Noria

The Guide to Lubrication Excellence

Lifecycle Stage 8

Energy Conservation, Health & The Environment (E)

- E1P Energy Conservation, Health & Environmental Impact
- E2P Storage & Disposal of Used Oil & Materials
- E3M Leakage Management
- E4M Energy Conservation, Health & Environmental Training
- E5K Energy Conservation, Health & Environmental KPIs

Lifecycle Stage 9

Condition Monitoring, Lubricant Analysis & Troubleshooting (A)

- A1P Machinery Selection for Condition Monitoring & Lubricant Analysis Program
- A2P Lubricant Analysis Test Slate—Periodic & Online
- A3P Lubricant Analysis Data Source Selection—Onsite Lab, Offsite Lab & Online Sensors
- A4P Sampling Tools & Methods
- A5M Selection & Integration of Inspection & Condition Monitoring Tasks
- A6M Lubricant Analysis Data Limits Selection & Interpretation
- A7M Troubleshooting & Root Cause Analysis
- A8M Condition Monitoring, Lubricant Analysis & Troubleshooting Training
- A9K Condition Monitoring, Lubricant Analysis & Troubleshooting KPIs

Lifecycle Stage 10

Contamination Control & Lubricant Reconditioning (C)

- C1P Contaminant Exclusion
- C2P Contaminant Removal & Lubricant Reconditioning
- C3M Contamination Control Objectives
- C4M Contamination Control & Lubricant Reconditioning Training
- C5K Contamination Control & Lubricant Reconditioning KPIs

The ASCEND™ Chart
 3 Levels • 6 Lifecycle Stages • 40 Factors

Backed by years of proven experience, Noria's ASCEND™ Chart is an effective tool for evaluating the current state of your lubrication program against world-class standards. The ASCEND™ Chart consists of three levels: Platform, Management and Training, and KPIs. These levels are divided into six lifecycle stages, starting with Lubrication Selection and contain 40 factors. The ASCEND™ Chart provides a quick and efficient visual representation to aid your lubrication program transformation. See noria.com/ascend for detailed use of the chart.

Lifecycle Stage 1

Lubricant Selection (S)

- S1P Lubricant Selection Process
- S2P Lubricant Supplier Selection
- S3P Lubricant Identification System
- S4M Consolidation & Optimization
- S5M Lubricant Selection Training
- S6K Lubricant Selection KPIs

Lifecycle Stage 2

Lubricant Reception & Storage (R)

- R1P Quality Control Process
- R2P Lubricant Storage & Lube Room
- R3P Lubrication Safety Practices
- R4M Inventory Management
- R5M Reception & Storage Training
- R6K Reception & Storage KPIs

Lifecycle Stage 3

Lubricant Handling & Application (H)

- H1P Lubricant Application Tasks
- H2P Machinery Configuration
- H3P Lubricant Handling & Application Devices
- H4M Lubrication Program Management
- H5M Lubrication Routes
- H6M Machinery Inspection Tools & Practices
- H7M Goals & Rewards System
- H8M Lubricant Handling & Application Training
- H9K Lubricant Handling & Application KPIs

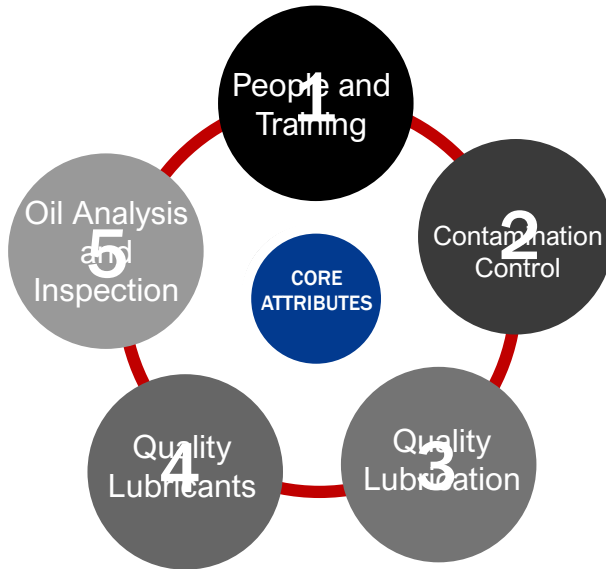
ICML 551 Subjects

Subject	ASCEND™ FACTORS
1 Skills	S5M, R3P, R4M, R5M, H7M, H8M, C4M, A8M, E4M
2 Machine	S3P, R3P, H2P, H3P, H4M, C1P, C2P, A4P, E3M
3 Lubricant	S1P, S2P, S3P, S4M, S6K, R2P, S4M
4 Lubrication	R1P, R4M, R5M, H1P, H2P, H3P, H4M, H5M, H6M, C1P, E3M
5 Tools	R1P, R2P, H2P, H3P, H4M, C1P, C2P, A3P, A4P, A5M, A6M, A8M
6 Inspection	R3P, R4M, H5M, H6M, C1P, C2P, A3P, A4P, A5M, E3M
7 Lubricant Analysis	R2P, H5M, H6M, A1P, A2P, A3P, A4P, A5M, A6M, A8M
8 Troubleshooting	H5M, H6M, C1P, C4M, A5M, A6M, A7M, E3M
9 Waste	S4M, R3P, R3P, R4M, C1P, C2P, E3P, E3M
10 Energy	S1P, H2P, H3P, C1M, E1P, E2P
11 Recycle	R3P, R4M, C2P, C3M, A2P
12 Management	S2P, S6K, R2P, R3P, R4M, R5M, H4M, H7M, H8M, C3P, E3P, E3M, A7M, A8K, E2P, E5K

The table above cross-references the 12 control subjects of the ICML 551 standard to the 40 factors of the ASCEND™ Chart. ICML 551 is a standard published by the International Council for Machinery Lubrication Asset Management, Inc. This standard was developed by the collaborative contributions of 45 subject matter experts in lubrication, lubricant selection, condition monitoring, reliability, maintenance and asset management. The cross-reference in this table enables the 40 ASCEND™ factors to be mapped to the requirements for verification to ICML 551. More information on this standard is available at lubecon.org.

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Core Attributes of Lubrication Excellence



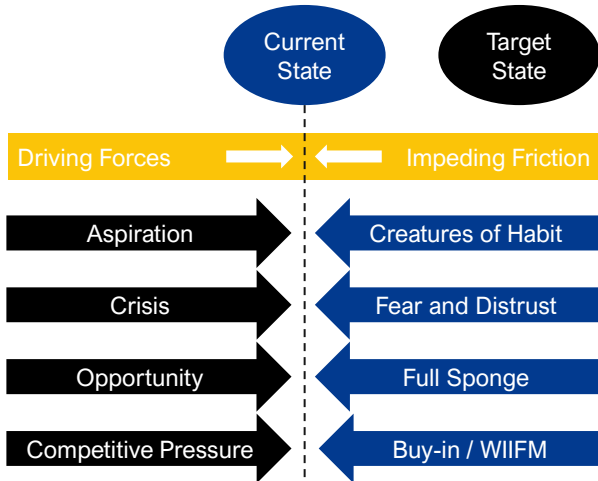
ingredion



1.

Machines Fail and Waste Occurs
 Because of What People Do... and
 What They Don't Do

A Body at Rest...



Getting Things Unstuck

The body at rest must be acted upon to induce change and close the gap between the current and desired state.

- Increase driving force
- Decrease restraining force (Impedance)

15

“70% of Production Losses are due to Human Error”

When people do bad work they feel bad about themselves and their job. When people do good work they feel good about themselves and their job. Training and empowerment enable good work

The Economics of Education

- When it comes to education, a penny saved is not a penny earned, but rather hundreds of dollars forfeited, all for the quest of a penny
- Teach an ounce of prevention
- You earn what you learn!

Cost of Prevention



Cost of Cure



Ingredient

16

Task-Based Training

The What
The How
The Why
The When
The Where

Operators, Millwrights, Trades

17

	LTJR	LTJR	LA JB	LA SR	LE	CP	OP	CBM	RE	MM	WH	PS	HSE
STRATEGY													
KNOWLEDGE													
SKILLS													
ATTITUDE													
CONSCIOUSNESS													



LUBRICATION GENOMA™

LUBRICATION ROLES / ROLES DE LUBRICACIÓN

CLAVE/KEY	ENGLISH	ESPAÑOL
LT JR	Lube Technician Jr.	Técnico en lubricación Jr.
LT SR	Lube Technician Sr.	Técnico en lubricación Sr.
LA JB	Lube Analyst Jr.	Analista de lubricantes Jr.
LA SR	Lube Analyst Sr.	Analista de lubricantes Sr.
LE	Lubrication Engineer	Ingeniero de lubricación
CP	Craftsman	Mecánico
OP	Operator	Operador
CBM	CBM Specialist	Monitoreo basado en condición
RE	Reliability Engineer	Ingeniero de confiabilidad
MM	Maintenance Manager	Gerente de mantenimiento
WH	Warehouse personnel	Almacénista
PS	Purchasing specialist	Especialista de compras
HSE	Health, Safety and Environment Specialist	Salud, seguridad y medio ambiente

18

2. Contamination Control is Fundamental to Machinery and Lubricant Health



Contamination Control and Proactive Maintenance

Modifications are needed to achieve these machine attributes

- Cleanliness
- Dryness
- Temperature
- De-aerated state

Ingredient

Proactive Maintenance in Three Easy Steps

- 1 • Set ORS Cleanliness Targets
 • Target Cleanliness Level Should Reflect Reliability Goals



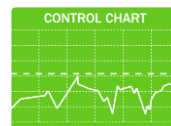
Make “Cleanliness” a Focal Point in Lubrication

- 2 Take Specific Actions to Achieve Targets (modifications)
1. Reduce Ingression
 2. Improve Filtration



Next, Focus on Reducing the Cost of Cleanliness

- 3 Measure Contaminant Levels Frequently
1. What Gets Measured Gets Done (Step 2)
 2. Post Control Charts of Measured Results



- Keep Numbers Conspicuous
- Deploy the Invisible Filter
- Remediate High Particles Counts Immediately

Ingredient 03801 Ref:JCF

Machine Life-Extension Table

		NEW CLEANLINESS LEVEL (ISO CODE)										
		20/17	19/16	18/15	17/14	16/13	15/12	14/11	13/10	12/9	11/8	10/7
CURRENT CLEANLINESS (ISO CODE)	26/23	5 4	3 2.5	7 4.5	3.5 3	9 6	4 3.5	>10 6.5	5 4	>10 7.5	5 4	>10 7.5
	25/22	4	2.5	5	3	7	3.5	9	4	>10	5	>10
	24/21	3	2	4	2.5	6	3	7	4	9	5	>10
	23/20	2	1.5	3	2	4	2.5	5	3	7	3.5	9
	22/19	1.6	1.3	2	1.6	3	2	4	2.5	5	3	7
	21/18	1.4	1.1	1.8	1.3	2.3	1.7	3	2	3.5	2.5	4.5
	20/17	1.3	1.2	1.5	1.5	2	1.7	3	2	4	2.5	5
	19/16	1.2	1.1	1.5	1.3	1.8	1.4	2.2	1.6	3	2	3.5
	18/15	1.2	1.1	1.5	1.3	1.8	1.4	2.3	1.7	3	2	3.5
	17/14	1.2	1.1	1.5	1.3	1.8	1.5	2.2	1.7	3	2	3.5
	16/13	1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.7	3	2	3.5
	15/12	1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.7	3	2	3.5
14/11	1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.7	3	2	3.5	
13/10	1.2	1.1	1.5	1.3	1.8	1.5	2.3	1.7	3	2	3.5	

Table Legend

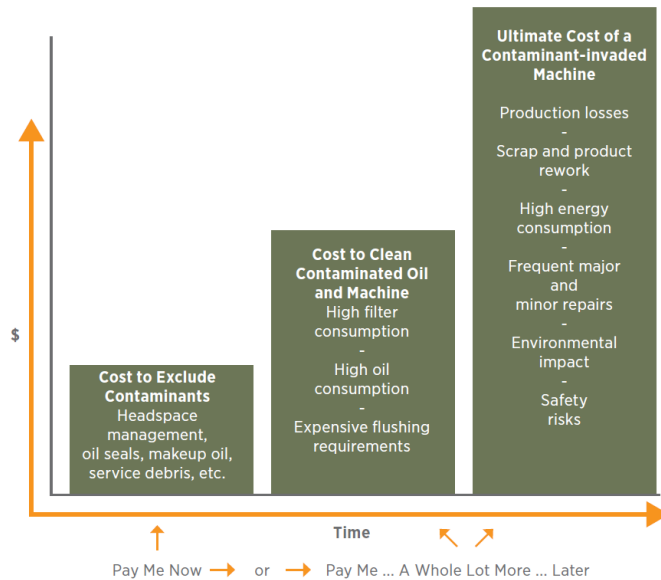
Hydraulics and Diesel Engines	Rolling Element Bearings
Journal Bearings and Turbo Machinery	Gear Boxes and Other

Based on ISO 4406:99 - 4 micron range has been omitted.

300% Increase in Life Extension

35% Increase in Life Extension

Getting the Waste Out of Contamination Control





3.

Quality Lubrication, Tools and Machine Readiness

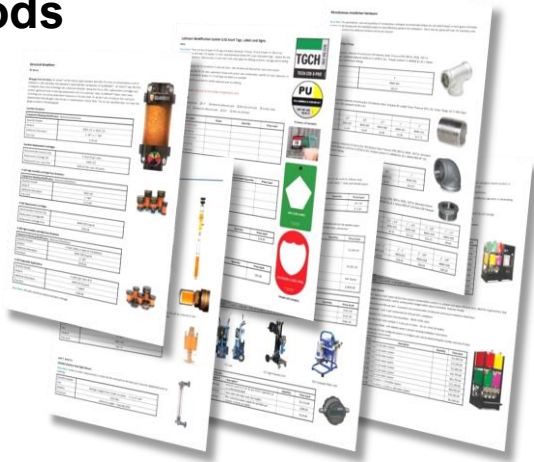
Readying machines for wellness and maintainability

As the old-timers are retiring, so must many of their tools and methods

23

Precision Procedures Define the Optimized Use of Tasks, Skills, Tools and Methods

- Storage and Handling
- Inspection
- Lubrication
- Contamination Control

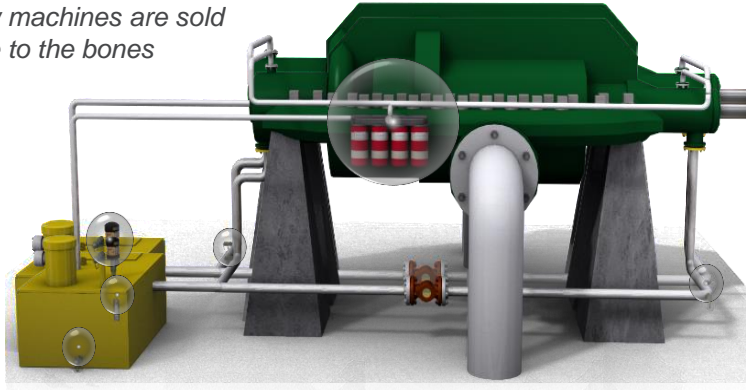


24

Getting Machine Modifications Right

- Breather
- Oil fill port
- Filtration
- Oil level inspection
- Oil sampling port
- Oil fill method/location
- Sensors

New machines are sold bare to the bones



25

The Lube Room is the Centerpiece of your Lubrication Program

- Cutting corners builds a culture of mediocracy
- Pigpen lube rooms become pigpen machines
- Be fussy and demanding about the right tools, pumps, hoses, grease guns, dispensing gear, totes, etc.
- Lubrication excellence starts with lube room excellence



26

Contents of a Well-equipped Lube Room

Ventilation with Filter

Explosion-proof Switches and Lighting

Fireproof Construction

LIS Identification™

Sealed Floor with Non-slip Epoxy Coating



Breather Filters

Oil Dispatch through Filters

Automatic Grease Application Systems (avoids opening grease drums)

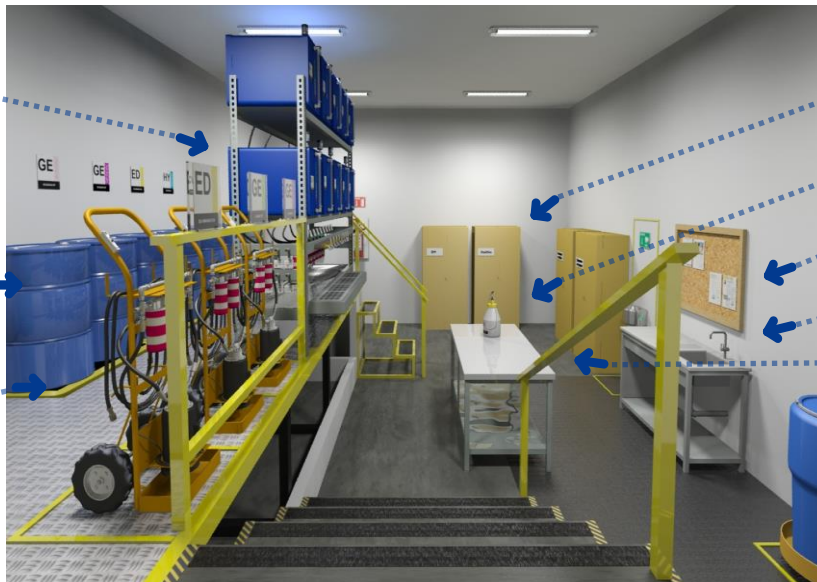
Solid Waste Container with Lid

27

Filtered lubricant containers

Grounded drums

Area for filtration carts



Cabinet with doors

Sealed and clean filling containers

Scoreboard

Washing area

Workbench

Leak containment

28



4.

Getting Lubricant Selection Right

Lubricants are what we buy. Lubrication is what we do

29

False Economies of Lubricant Selection

The Lure of Cheap Oil

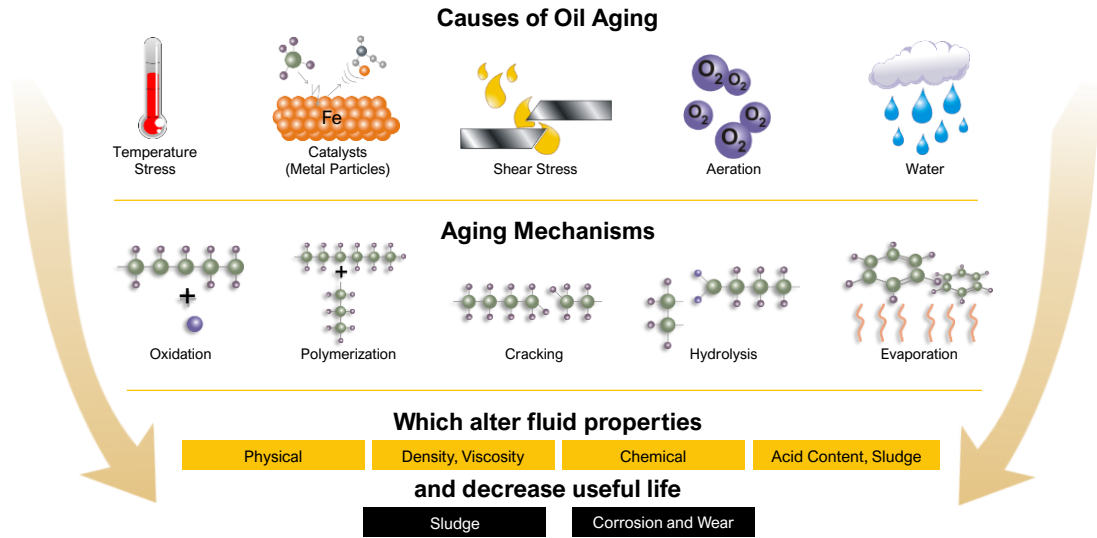
Attempting to save money by buying economy-formulated lubricants for the wrong application

False Promise of Forgiveness

Attempting to remedy bad lubrication practices by buying expensive premium lubricants

30

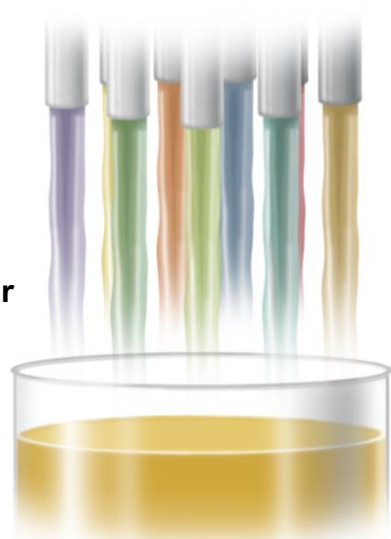
The Oil Aging Process...No, It Doesn't Last



31

These Lubricant Additives Don't Exist

- Anti-dirt
- Sludge Pacifier
- Soot Terminator
- Oil Starvation Deactivator
- Cheap Basestock Enhancer
- Excessive Grease Decomposer
- Water Zapper
- Glycol Neutralizer
- Wrong Oil Inhibitor



32

Ingredient

Ingredient

Finding Real Economies in Your Lubricant Spend

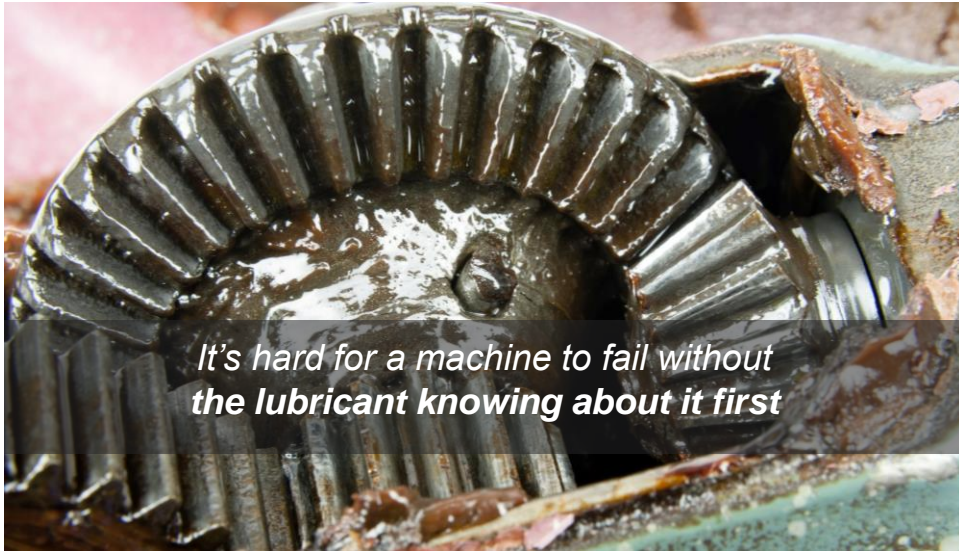
	GEAR OIL	HYDRAULIC FLUID	TURBINE OIL	MOTOR OIL	TOTAL
Current Annual Spending	\$70,000	\$120,000	\$180,000	\$40,000	\$410,000
1. Precision Optimum-life Lubricant Selection	-\$15,000	-\$5,000	-\$21,000	-\$4,000	-\$45,000
2. Proactive Lubricant Life Extension	-\$13,000	-\$3,000	-\$12,000	-\$3,000	-\$31,000
3. Optimizing the Relube Interval	-\$6,000	-\$15,000	0	-\$5,000	-\$26,000
4. Reducing Package Waste	-\$1,200	-\$2,200	0	0	-\$3,400
5. Reducing Leakage	-\$500	-\$22,000	0	0	-\$22,500
Optimized Annual Spending	\$34,300	\$75,800	\$147,000	\$28,000	\$285,100
Percent Cost Reduction	51%	37%	18%	30%	30%
Annual Savings	\$35,700	\$44,200	\$33,000	\$12,000	\$124,900



5.

Oil Analysis and Inspection

Constant performance measurement, reporting and course corrections are signs of good maintenance culture



35

The Flight Data Recorder in Your Oil

Your Oil is Talking...



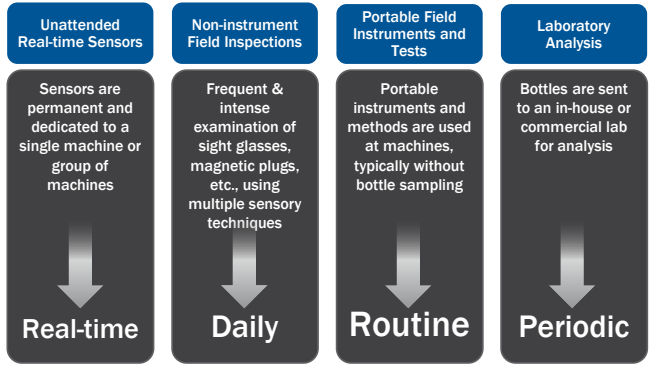
But are You Listening?

But First, Who's Going to
Answer these Questions?

- Right machines to sample?
- Right sampling frequency?
- Right sampling location?
- Right sampling procedure?
- Right lab selection?
- Right tests to perform?
- Right alarms and limits?
- Right data interpretation strategy?

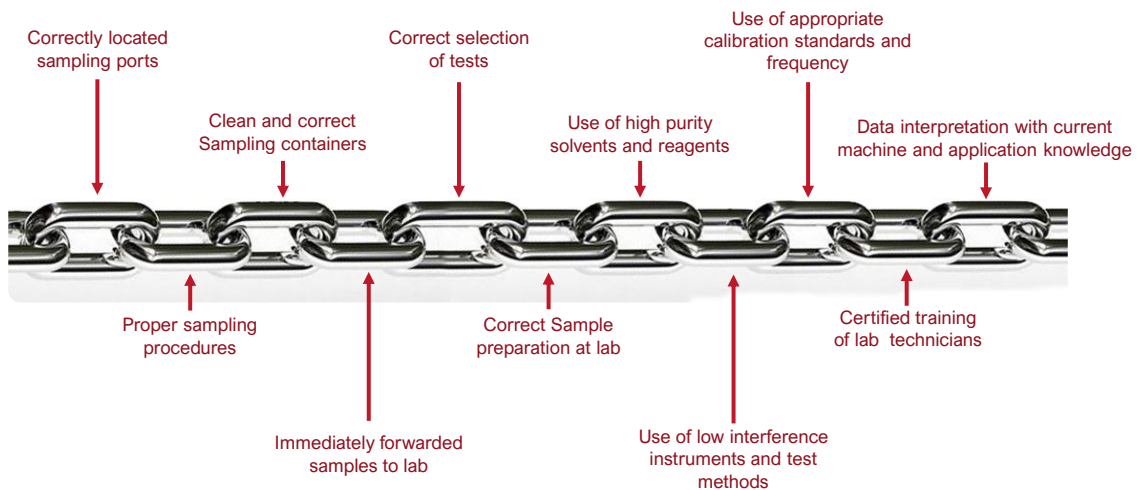
36

Oil Analysis Done Four Ways... The Optimum Choice is?



37

Oil Analysis Integrity Begins with the Sample



Ref: Noria

03506

38

Three Categories of Oil Analysis

	1.Fluid Properties Physical and chemical properties of used oil (aging process)	2. Contamination Fluid and machine destructive contaminants	3. Wear Debris Presence and identification of wear particles
Particle counting	○	●	◐
Moisture analysis	○	●	○
Viscosity analysis	●	◐	○
Ferrous density	○	○	●
Analytical ferrography	○	◐	●
AN/BN	●	◐	◐
FTIR	●	◐	○
Patch test	○	●	◐
Flash point	◐	●	○
Elemental analysis	●	◐	●
	Proactive	Proactive	Predictive

● Primary benefit
◐ Minor benefit
○ No benefit

Ingredion:00064 Ref:JCF

39

Remember these Hidden Objects Puzzles from Highlights Magazine?

Can you find the objects on the list?

What if you didn't have the list?

Could a super-computer find them?



- Kite
- Flashlight
- Cowboy boot
- Whale
- Balloon
- Slice of pie
- Bird
- Tea cup
- Compass
- Ice cream cone
- Magnifying glass
- Rhino head
- Banana

40

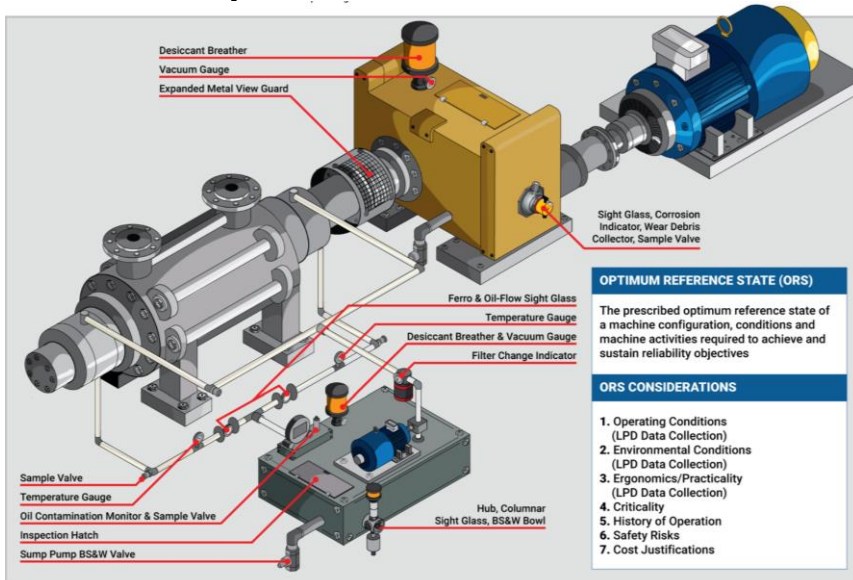
Can You See the Ten Reportable Conditions in this Sump?



- How many would have been reported by your current inspection program?
- Or by your laboratory from a sample of oil?
- Or by your vibe program?

41

Machine Inspection Modifications



42

What Should You do Immediately if You Saw These?



43



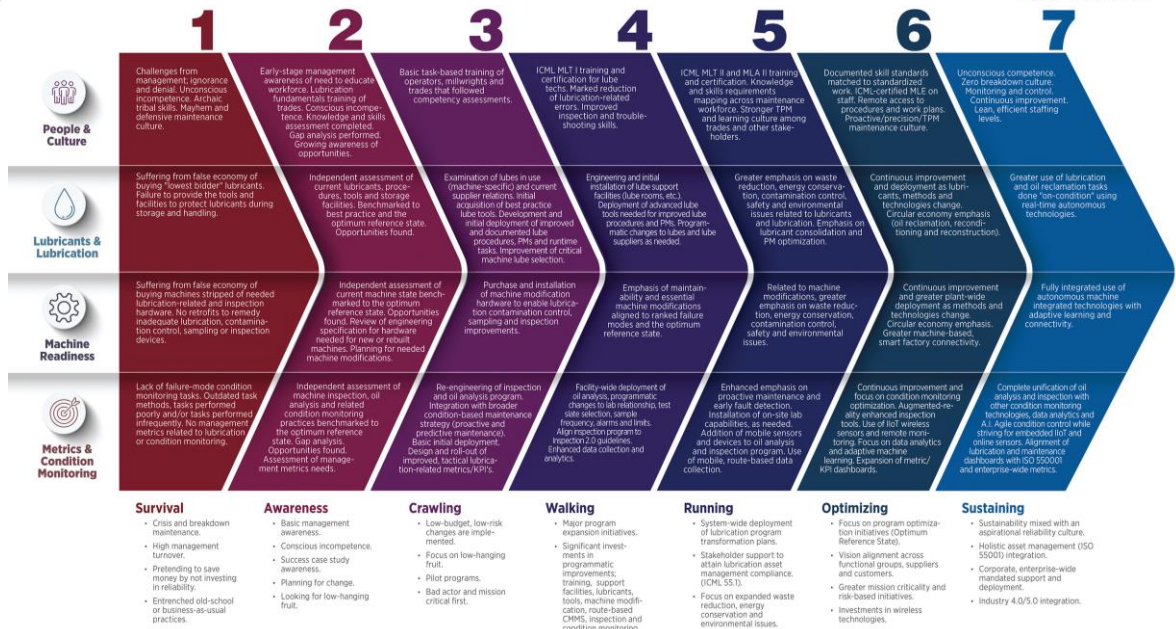
*Don't
Assume
They
Already
Know*

44

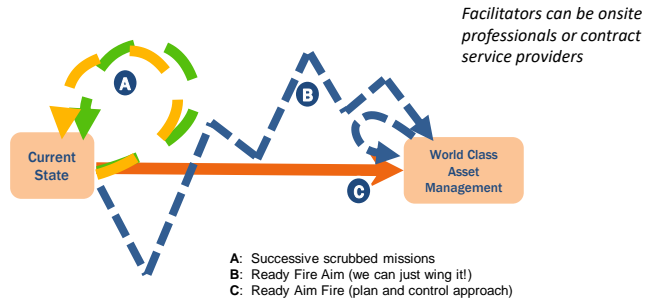
A Lubrication Management System (LMS) is the Heartbeat of a Lubrication Program



The Journey...Seven Levels of Lubrication Excellence



Navigating the Journey



The World Rewards Action

Thank you

Jim Fitch
jfitc@noria.com
918 605 5465
Noria Corporation





Thank you!

Jim Fitch

jfitch@noria.com

918 605 5465

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