monico™

SIMPLE SOLUTIONS. POWERFUL MONITORING.

GUARD®

MachineWatch™

Built on monicolive™

INFORMATIONAL BROCHURE

1

What is it?

In this section we explain what **mGuard® MachineWatch™** is.

2

What does it do?

An in-depth explanation of what **mGuard® MachineWatch™** does.

3

How does it work?

In this section we present how **mGuard® MachineWatch™,** using **mCore®SDR**; captures real-time data from mining assets and sends that data to **MonicoLive™** where predictive analytics are run in real-time.

4

What's required?

This section covers everything needed to implement **mGuard® MachineWatch™** and explains the systems that are being monitored, the analytics that are being run and how it all is wired up; preconfigured ready for installation.

5

What's included?

Automated Predictive Analytics, Advanced Notification System, Data Visualization and Data Storage is all included in **mGuard® MachineWatch™**.

Why you need it and the benefits

1 What is it?

mGuard® MachineWatch™ is remote ***condition*** monitoring for your mining assets (i.e., mobile, field, and ancillary equipment). Monico's Engineers work with you to determine exact hardware requirements to collect, aggregate, cleanse, translate, buffer and transmit your real-time stamped data to **MonicoLive™** servers.

Users have access to:

Industrial Data Acquisition and Storage
Real-time, stamped machine data

Data Visualization Environment
Digital dashboards of real-time and historical data
Asset status overview & operational KPI's
Active Faults/Alarms

Predictive Analytics for Condition Monitoring
Preconfigured analysis and automated notifications
Designed to run automatically 24/7/365

MachineWatch™ is built on the trusted **MonicoLive™** platform hosted in the Microsoft® Azure cloud. Our automated analyses and notifications are completely setup and managed by Monico's Subject Matter Experts and specifically designed to save you money through improved asset reliability, reduced unscheduled shutdowns and improved preventative maintenance planning.

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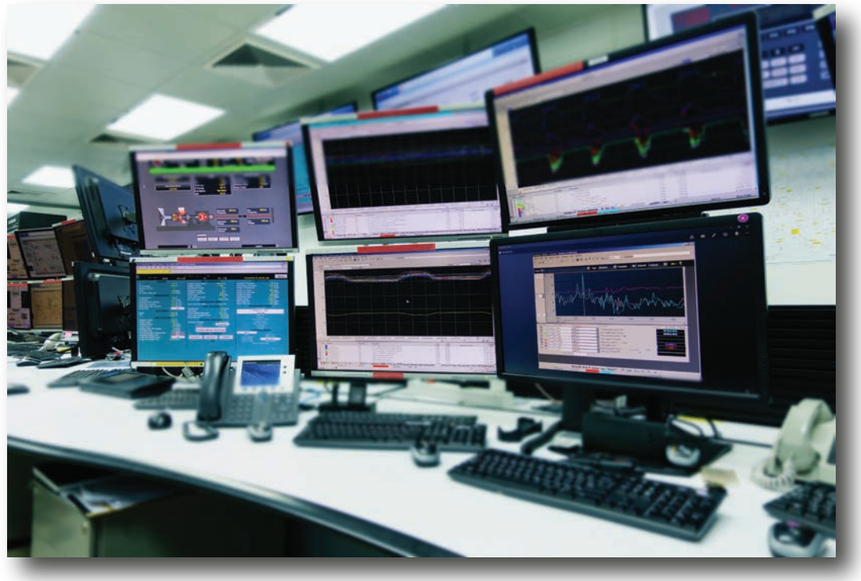
2 What does it do?

Key Point:
Condition monitoring is the process of monitoring parameters in machinery (pressures, rotations, temperatures etc.), in order to identify a significant change which is indicative of a developing fault and enables the potential problem to be managed proactively in order to prevent an unscheduled outage. It is a major component of predictive maintenance.

mGuard® MachineWatch™ is a tool that provides maintenance managers, technicians, and reliability engineers with improved insight as to how the assets, and the individual components of each asset are performing and their health statuses.



Tool for performing CONDITION-BASED MAINTENANCE

Helping to improve:

Optimization
Uptime
Reliability

It's used to Analyze Real-Time Streaming data

Visualization, human review and interaction
Automatically, triggering alerts/notifications

Condition Monitoring is using data from mining assets to evaluate the state of components of the system to determine if any of those components are beginning to show signs of failure. The purpose of **mGuard® MachineWatch™** is to run real-time analytics on mining machines to determine the status of their health.

Objective of CONDITION MONITORING:

Detect end of useful life
Detect reliability related failures

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3 How does it work?

mGuard® MachineWatch™ collects real-time streaming data from the mining assets; including the engine, chassis, drive, hydraulic and grease systems from the ECM's.

Key Point:
mCore®SDR is the industrial data acquistion device that is collecting data from connected assets. The data is then sent to the MonicoLive™ Cloud environment where mGuard® MachineWatch™ is analyzing data in real-time

Edge Networks/Sensors

- External Sensors
- Engine Networks
  - CDL
  - J1939

May require additional I/O module

Harness Kit
Approximately 4-10' Harness

mCore SDR

- ☑ Data Collector/Aggregator
- ☑ Protocol Conversion
- ☑ Edge Analytics
- ☑ Data Prep for Transmission
- ☑ Data Logging
- ☑ **Data Buffering (OMF/MQTT)**

Data buffering is imperative when remotely monitoring over potentially inconsistent network connection to minimize the risk of data loss

Data Haul Options

1. **Option 1**
   Existing **Ethernet Network**
2. **Option 2**
   Uses connection to **Wi-Fi client radio**
   - Antennae
   - Wireless Client
   - Wi-Fi Client
3. **Option 3**
   Uses **Satellite** terminal or **Cell** modem
   - Satellite/ Cellular

3 Options for Data Haul (Transport)
1) Direct Ethernet Connection
2) WiFi Client Connection to WiFi Access Point)
3) Cell/Satellite Transmission

WAN Access Point

Customer Systems

- LAN
- ModBus → SCADA or other Systems
- MQTT → IIOT, Analytics, AI/ML platforms
- MQTT / OMF → AVEVA Pi System Connector

MQTT/OMF

Hosted in the highly secure **Microsoft® Azure Cloud**

MonicoLive™
Built on the **AVEVA PI System** AVEVA

Data Archive

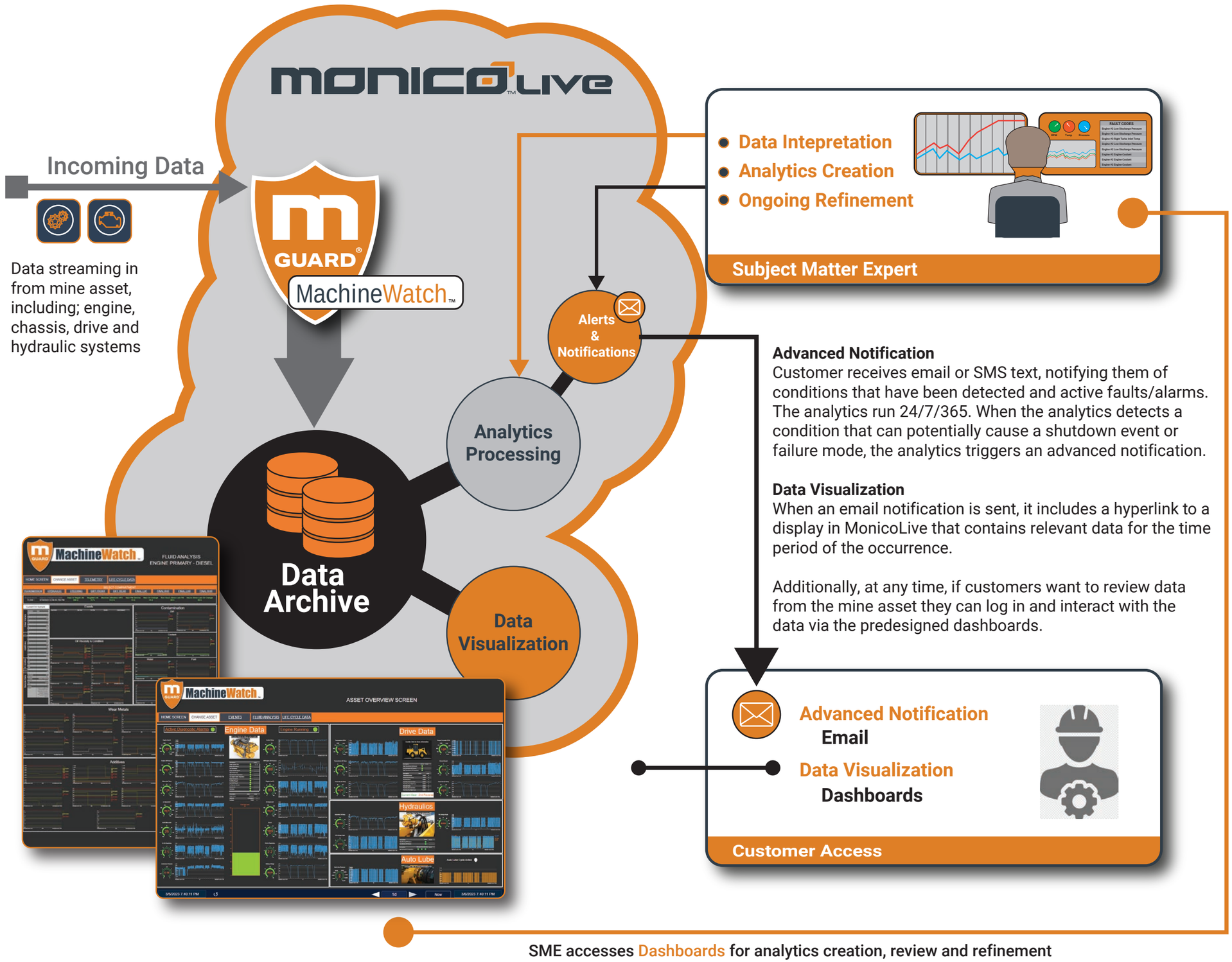
mGuard® MachineWatch™
Automated Predictive Analytics

Review next secton for what happens when data gets to mGuard® MachineWatch™ in MonicoLive

mGuard® MachineWatch™

Key Point:

Once data is received into MonicoLive™ it is then processed in real-time by mGuard® MachineWatch™ analytics to determine if any conditions are presenting that may require advanced notification and attention by maintenance and service professionals



Advanced Notification
Customer receives email or SMS text, notifying them of conditions that have been detected and active faults/alarms. The analytics run 24/7/365. When the analytics detects a condition that can potentially cause a shutdown event or failure mode, the analytics triggers an advanced notification.

Data Visualization
When an email notification is sent, it includes a hyperlink to a display in MonicoLive that contains relevant data for the time period of the occurrence.

Additionally, at any time, if customers want to review data from the mine asset they can log in and interact with the data via the predesigned dashboards.

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4 What is required?

HARDWARE

Key Point:
Monico **mCore®SDR** are:
IP66/IP67 Enclosures – Water and Dust Resistance

Class I, Division II Certification - Haz. Loc. Approved
Groups A-D, Surface Temp T5A.

INTERFACE CABLING

mGuard® MachineWatch™ does not require expensive sensor package addons

MachineWatch remote **condition** monitoring can be accomplished with the installation of a data acquisition gateway (**mCore®SDR**), and a wiring kit harness.

If an ethernet access to a network is not available, a cellular modem can be installed.

All of the data acquisition, automated analytics and alert/notifications are accomplished with typical sensor packages. Additional expensive sensor solutions are not required.

>> For more information on mCore®SDR click here

Every installation of **mGuard® MachineWatch™** comes with interface cabling preconfigured to connect to the appropriate destinations.
(e.g., engine ECM, CANbus ports, CDL, etc)

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5 What is Included?

AUTOMATED ANALYTICS

Key Point:
All analytics are designed to run 24/7/365 and require no human interaction to perform. The analytics run in real-time as data is received from the mine asset.

Monico's **mGuard® MachineWatch™** includes real-time analytics that run unattended 24/7/365 as data streams in from the asset(s).

- ☑ There is no need to download data records, CAN logs or other information to run analytics manually in spreadsheets or other tools
- ☑ No need for a human to be actively involved in analyzing data (it works while you sleep)

Automated notifications and analysis include, but are not limited to:

Engine & Components
Hydraulic System & Components
Drive System & Components
Chassis & Components
Cooling Systems
Air Intake Systems
Lubrication Systems
Equipment KPIs (e.g., Reliability)

MachineWatch™ Analytics help operations & reliability:

Optimize Production
Reduce Unexpected Shutdowns from component failures
Reduce Excessive Parts & Labor Cost

- **Avoid extra cost for incorrect and or expedited parts**
- **After-hours labor (scheduled versus reactionary)**
- **Avoid additional costs associated with failure mode misdiagnosis. (i.e., removing incorrect part)**

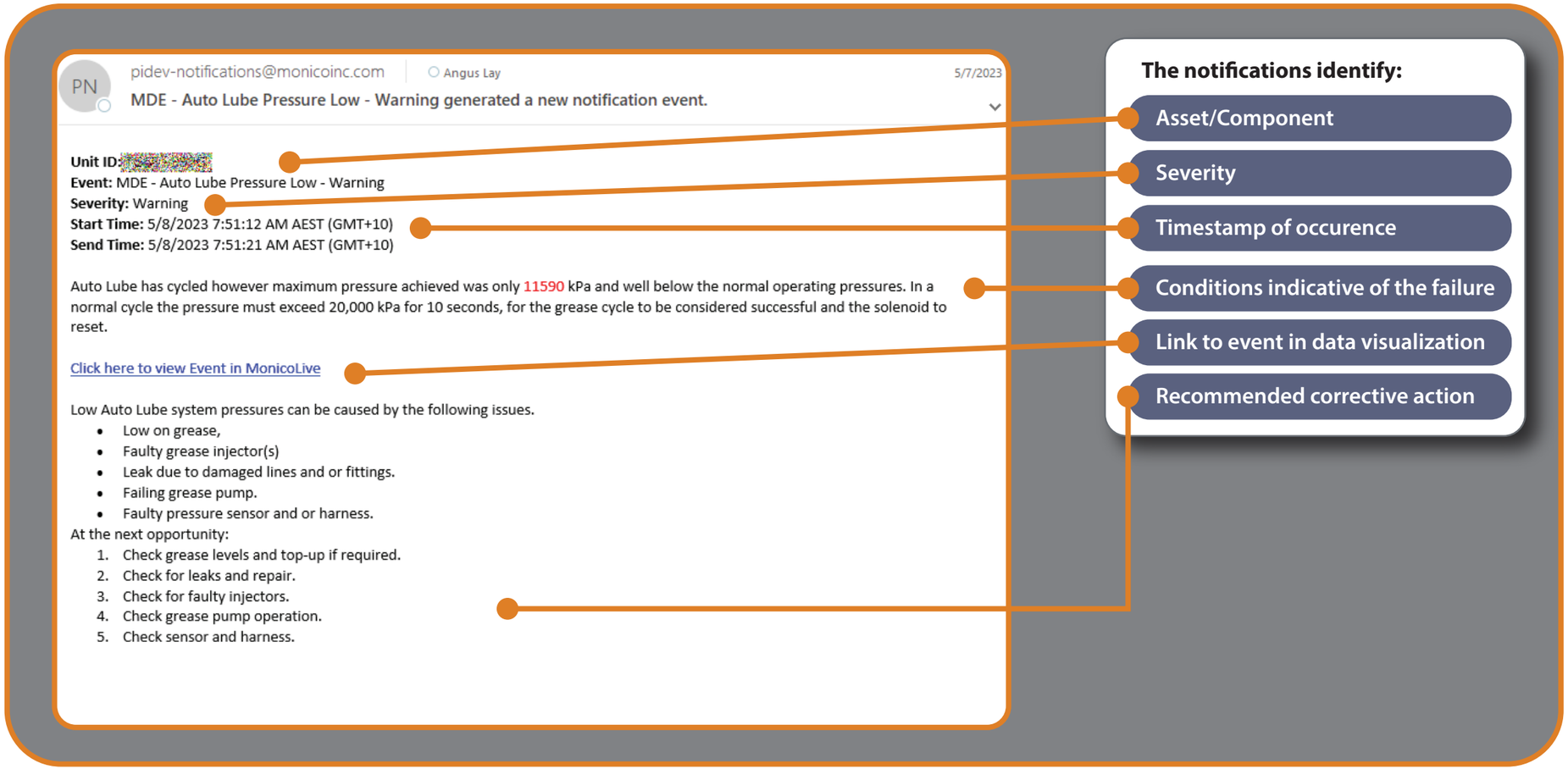
ADVANCED NOTIFICATIONS

A key feature to **mGuard® MachineWatch™** is the Advanced Notifications.

When **MachineWatch™** identifies a potential failure or shutdown, the system will trigger an email notification. These notifications provide the name of the asset, time of occurence, severity, the types of conditions that are indicative of a failure, *recommended action* and a hyperlink to **MonicoLive**.

Key Point:
Advanced notifications provide a direct link to MonicoLive™ at the time of the event; this makes it easy to quickly get to the root of the problem and perform additional human analysis of the data coming from the asset.

Monico's mGuard MachineWatch generates Automated Advanced Notifications



Dashboards/ Data Visualization

Key Point:

All dashboards are preconfigured and setup for the asset it's depicting data on.

Additionally due to the availability of historical data, the dashboards provide a DVR type functionality that allows the user to move back-wards and forwards along the timeline of data. Users can also move to a specific date/time.

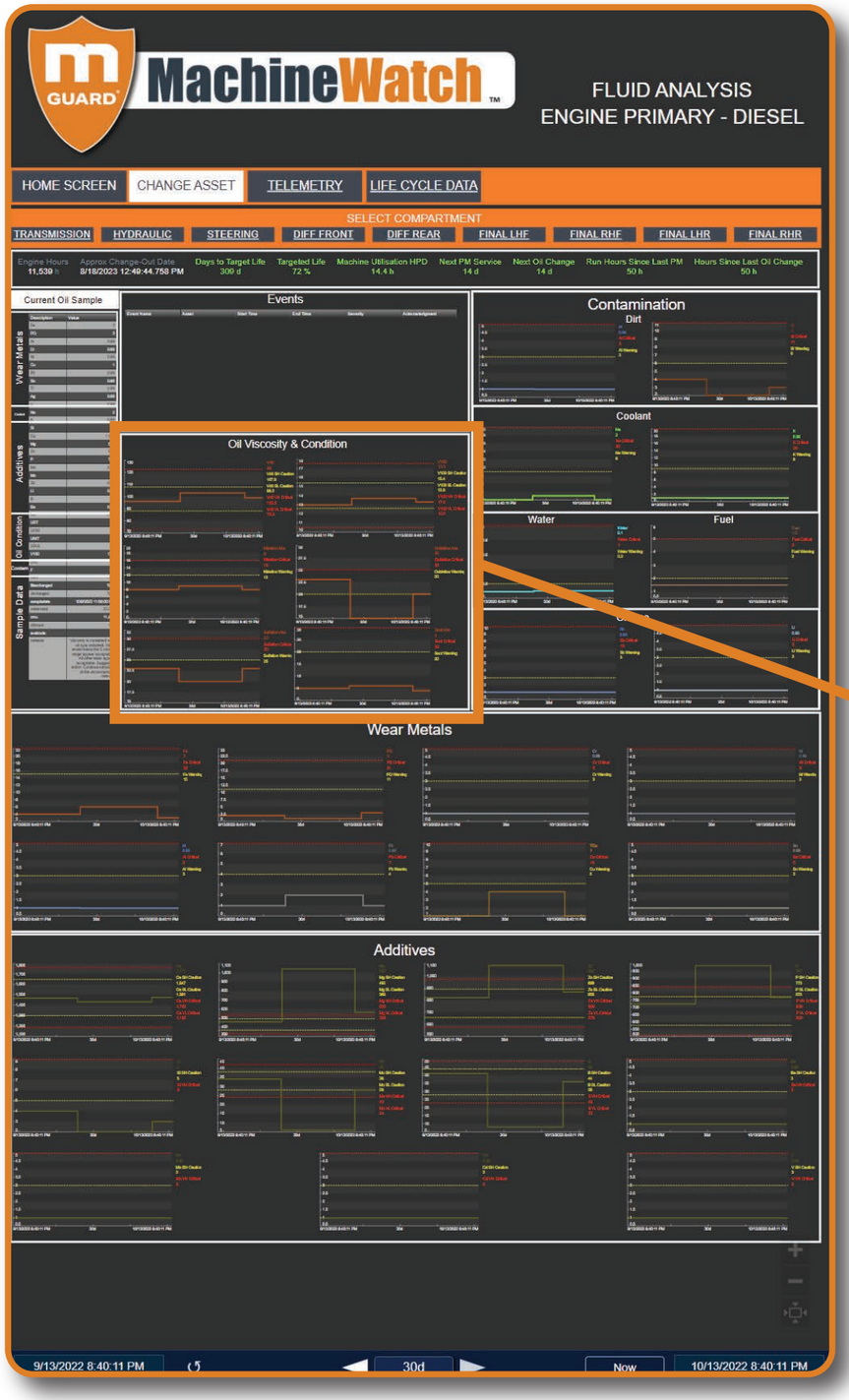
Another key feature of **mGuard® MachineWatch™** is the Data Visualization environment or **Dashboards**. Built on MonicoLive, **MachineWatch™** provides a full suite of visualizations.

Displays for:

Asset Overview
Engine
Intake
Exhaust
Drive
Chassis
Hydraulic systems
Grease System
Oil Analysis Detail
Component Life Tracking
Event & Diagnostic Codes

Fluid Analysis

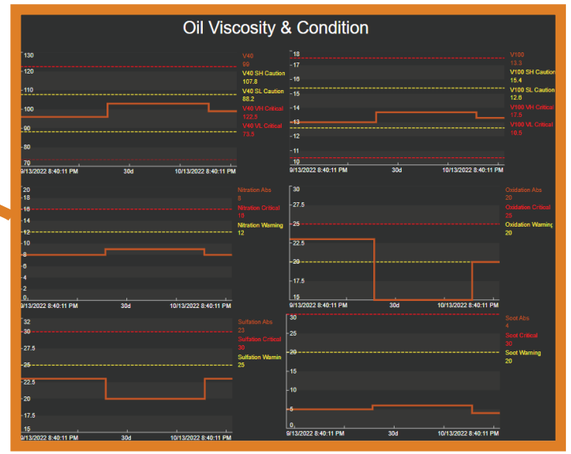
Included in the visualizations are dashboard(s) for Fluids Analysis



Integration of independant Fluids Sampling Data

mGuard® MachineWatch™ combines the machine telemetry and fluids analysis data, and brings together what had previously been disparate silos of machine health data, enabling MachineWatch MDE's (Monico Defined Events) to use both the fluid analysis (i.e., engine oil, transmission fluids, hydraulic fluids) and telemetry data in combination, to better predict failure at the earliest onset.

Previously, this would require people with experience in both machine telemetry data and fluids analysis to spend time reviewing all the available data, then from their experience, determine the underlying cause of the condition affecting the machine health and appropriate corrective action. Some of the downsides to this is firstly the time taken to physically review the oil analysis reports and the corresponding telemetry data, secondly finding the right people with the necessary skill sets and experience and that have the knowledge across multiple machine types and different OEM's is difficult, thirdly if these people leave the business their knowledge and experience leaves with them.



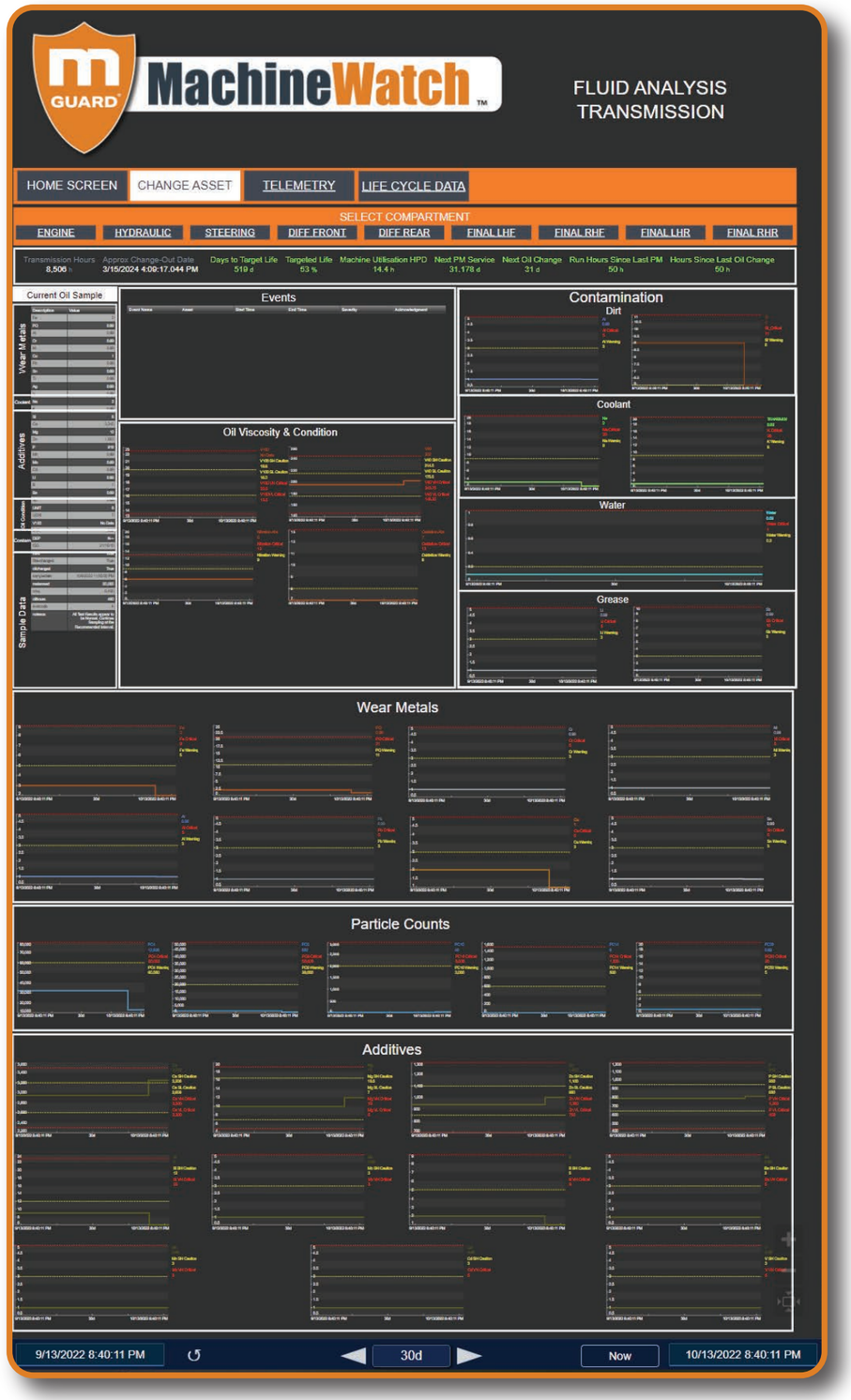
Enlarged from inset

mGuard® MachineWatch™ reduces these downsides considerably, by removing the need to manually review large volumes of data and enabling the focus to be on fixing the underlying issue, rather than spending time identifying it. The failure modes are built into the MDE's and don't leave with the people.

Having both datasets combined enables more precise failure identification, at the earliest possible onset.

mGuard® MachineWatch™ is watching 24/7, continuously analysing Gb of data all in a matter of milliseconds.

Fluid Analysis

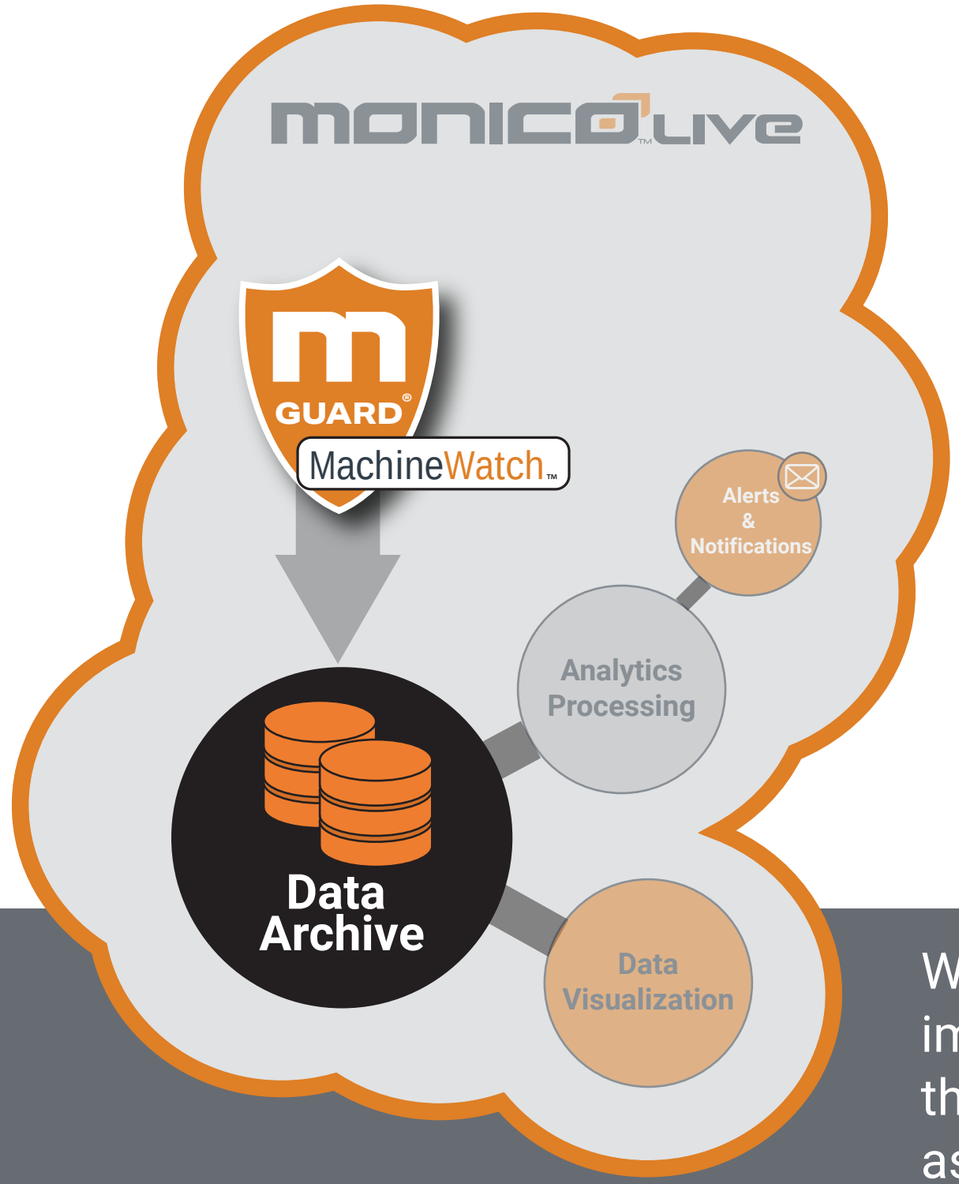


Fluid(s) Analysis Dashboards include:

- Engine Oil
- Hydraulic Systems
- *Transmission System*
- Front Differential
- Rear Differential
- Final LHF
- Final RHF
- Final LHR
- Final RHR

HISTORICAL DATA STORAGE

Data Archiving and Storage



Data Archiving is important for a **remote *condition* monitoring** solution as it provides the opportunity to ‘go back’ and historically review what was happening and to perform analytics on data that is slowly trending over time.

- ☑ **Save money on data storage**
- ☑ **No setup of servers required**
- ☑ **Data backup**
- ☑ **Data availability**

With **mGuard® MachineWatch™** being implemented on **MonicoLive** and hosted in the Microsoft® Azure Cloud; you can rest assured that data is backed up, has a high availability and is securely protected.

GUARD® MachineWatch™

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Why you need it and the benefits?

It helps maintenance professionals by increasing awareness of how their mining assets are performing. It does this by alerting them to any potential conditions that may result in an unplanned shutdown event or catastrophic failure. This increased awareness, along with a proactive approach to maintenance, can provide increases in productivity and help with scheduling maintenance intervals.

mGuard® MachineWatch™ provides service managers, technicians and maintenance crews with a powerful tool that is specifically designed to provide valuable insight into the performance and health status of their mine assets.

This advanced technology is proven to provide:

- ☑ **More time to schedule and prepare for needed repairs**
- ☑ **Useful analysis that aids in determining the severity of a failure**
- ☑ **Reduced unnecessary and or unscheduled repairs**
- ☑ **Improved Mean Time to Repair (MTTR)**
- ☑ **Improved Reliability, Utilization and Mean Time Between Outage (MTBO)**
- ☑ **Increased production and reduced unscheduled downtime**

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For more information please reach out to Monico at:

Web: www.monicoinc.com
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For more information on MonicoLive™

The cloud based solution that mGuard® MachineWatch™ runs on.

https://www.monicoinc.com/monicolive

For more information on mCore®SDR

Monico's industrial gateway for data acquisition; protocol translations, edge analytics and more...

https://www.monicoinc.com/mcore-sdr