EMERSON EXCHANGE 2025

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Enabling Remote Vibration Monitoring with AMS Vibration Monitor & Machine Works

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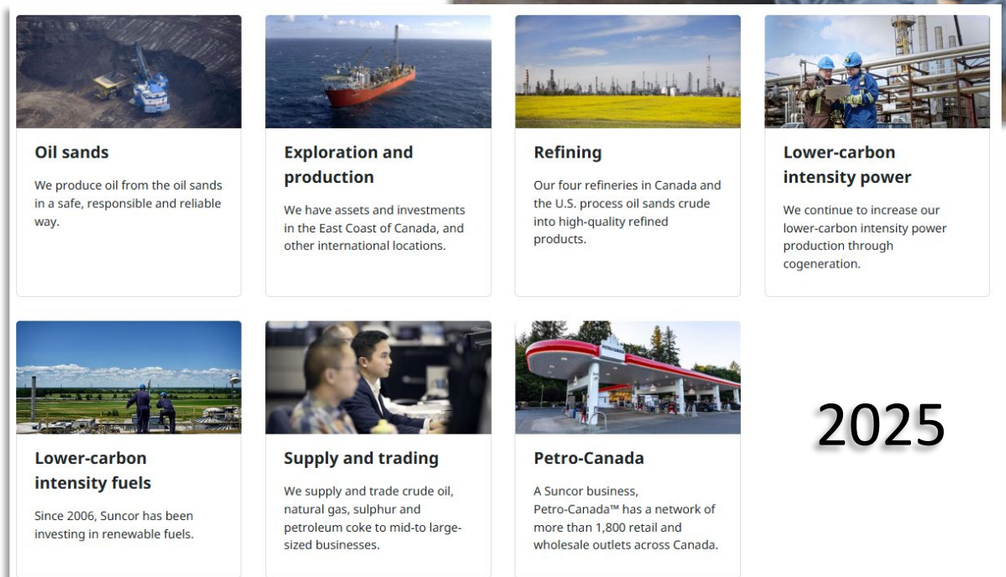
About Suncor

- Suncor Energy is **Canada's leading integrated energy company**. Suncor's operations include **oil sands development, production and upgrading; offshore oil production; petroleum refining in Canada and the U.S.**; and the company's Petro-Canada™ retail and wholesale distribution networks (including Canada's Electric Highway™, a coast-to-coast network of fast-charging EV stations).

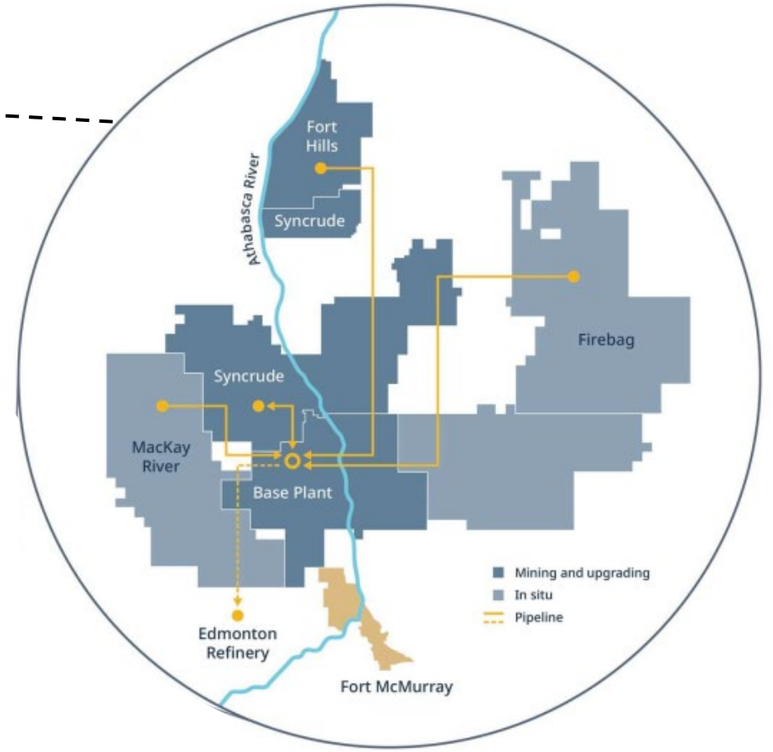
- Suncor is developing petroleum resources while advancing the transition to a lower-emissions future through investments in lower emissions intensity power, renewable feedstock fuels and projects targeting emissions intensity.

- Suncor also conducts energy trading activities focused primarily on the marketing and trading of crude oil, natural gas, byproducts, refined products and power. Suncor's common shares (symbol: SU) are listed on the Toronto and New York stock exchanges.



Learn more on: www.suncor.com/who-we-are/history

There is integration...and there is “Suncor Integration”



Upstream production	Refining capacity	Product sales
Oil Sands mining Oil Sands in situ East Coast offshore	Edmonton Montreal Sarnia Commerce City	PETRO-CANADA
825,000 bpd[1]	**466,000** bpd	**570,000** bpd[1]

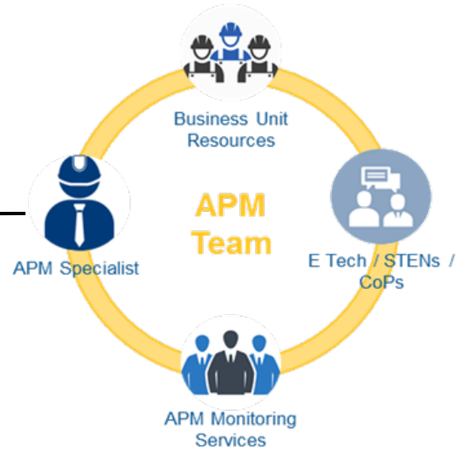
1. Notes and advisories available on www.suncor.com/investors

Advanced Condition Monitoring – APM (RAW)

APM (RAW) Overview

Asset Performance Management (APM) (RAW) is part of Suncor's Reliability Enablement journey. It leverages **R**emote monitoring, **A**dvanced analytics, and a collaborative **W**orkflow (RAW) to enable predictive asset maintenance and identification of risks to future asset performance.

Once analytical models are developed and deployed, the **APM Specialists** monitor these models and work with sites to triage, investigate and action any advanced alerts.

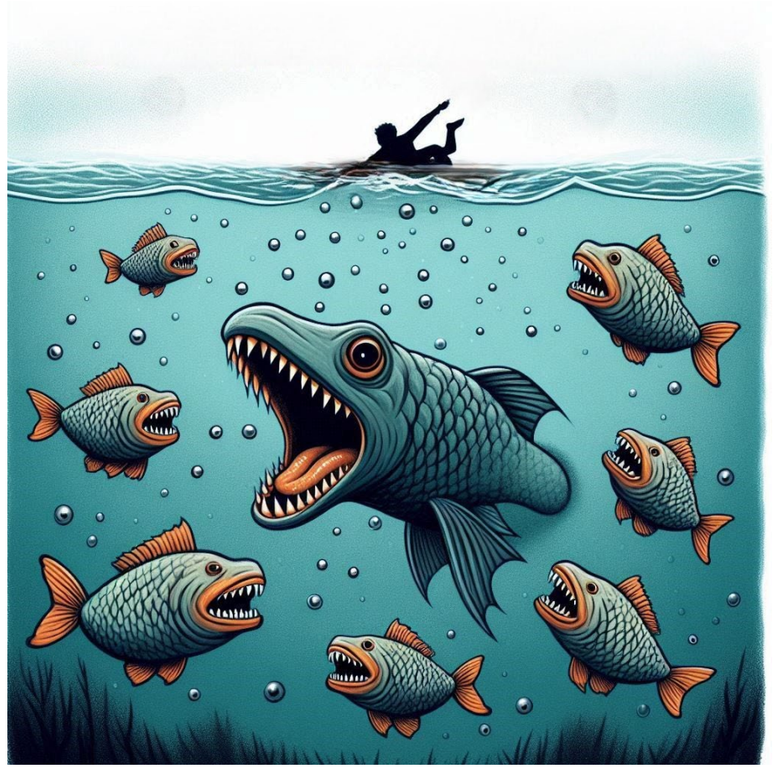


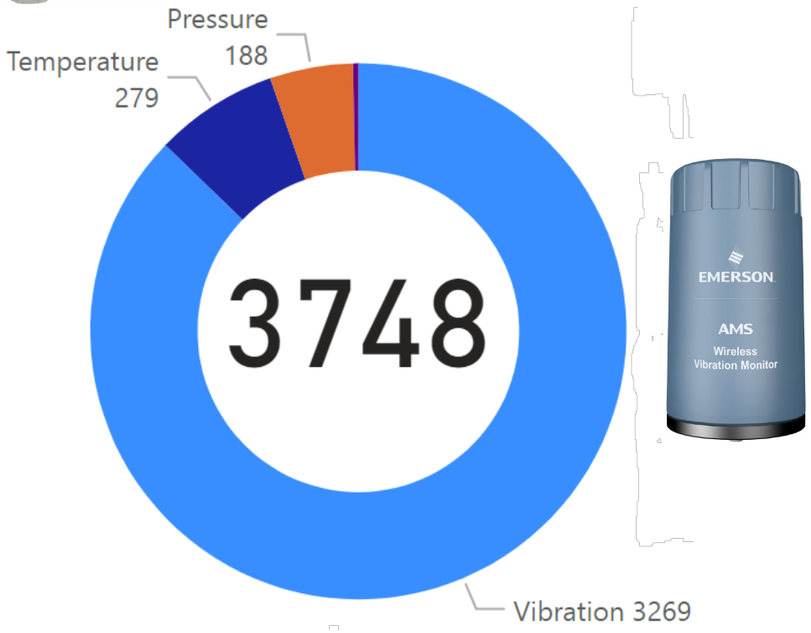
Working as a collaborative unit, the APM Team monitor Suncor's assets providing Advanced Condition Monitoring to critical assets

Benefits

Time to Plan	Damage Reduction	Asset Strategy Optimization	Institutionalized Knowledge	Collaborative Work Environment
Reduce LOV, reduce planned maintenance costs	*Catch anomalies before secondary damage occurs*	*Do the right work at the right time via early detection*	*Shared learning and centralized expertise across the enterprise*	*Access to expertise (i.e. STENs, Enterprise Tech etc.)*

Mitigating risk and closing the data gap

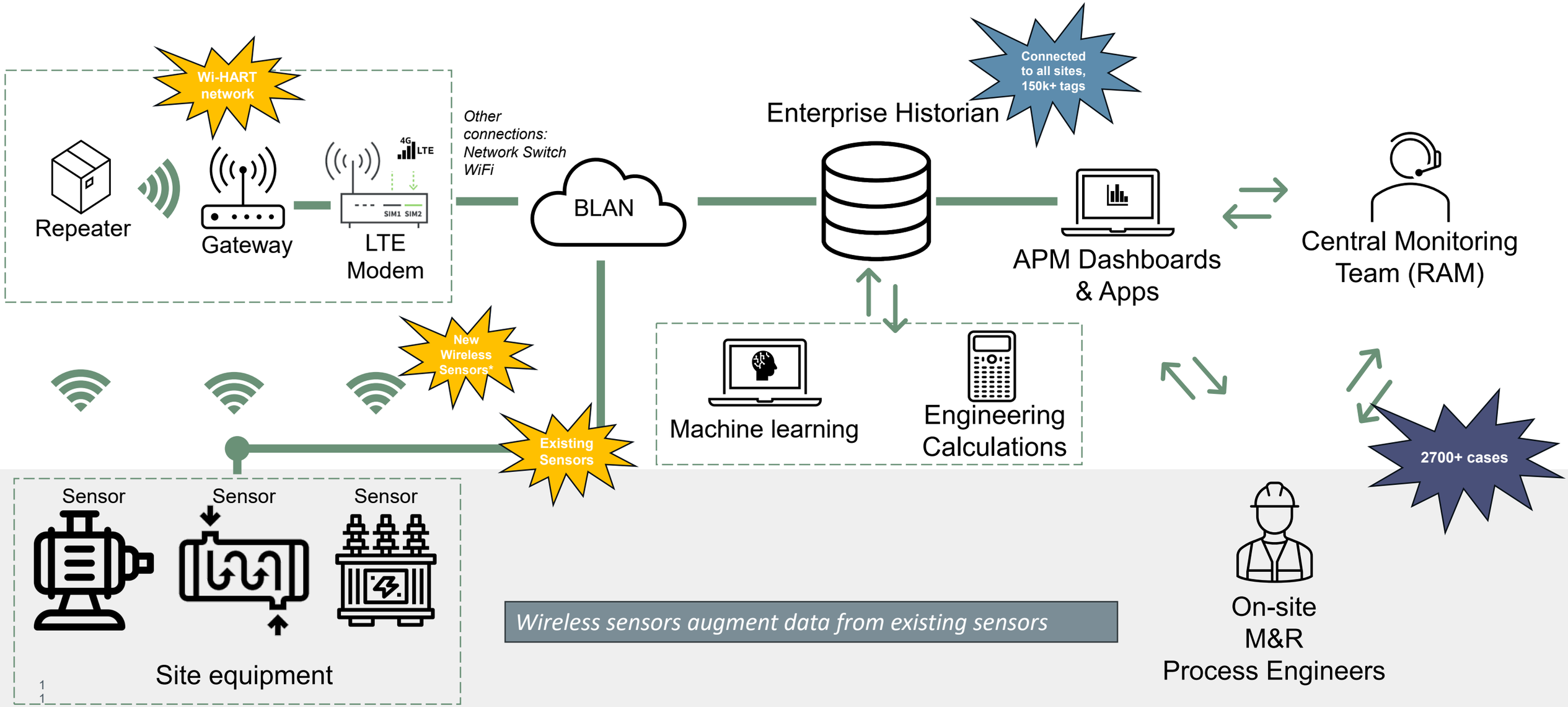




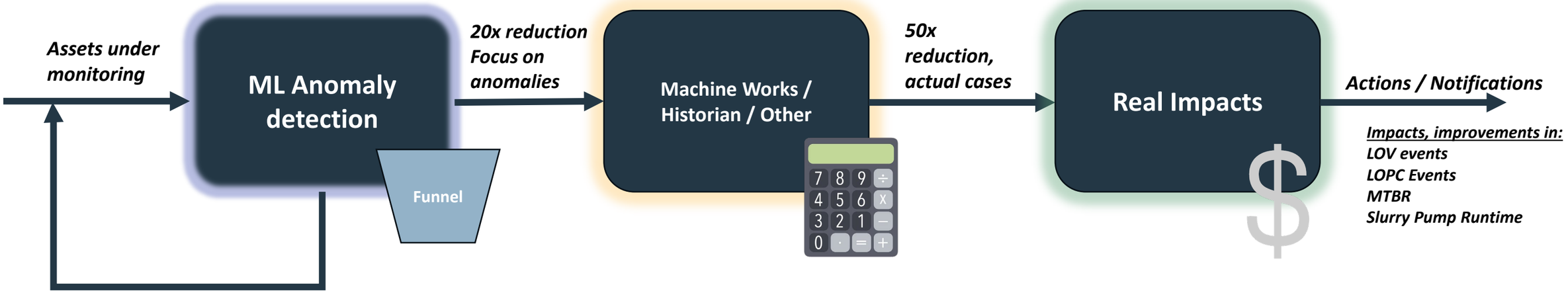
It's all about being prepared and informed to make the best decisions.

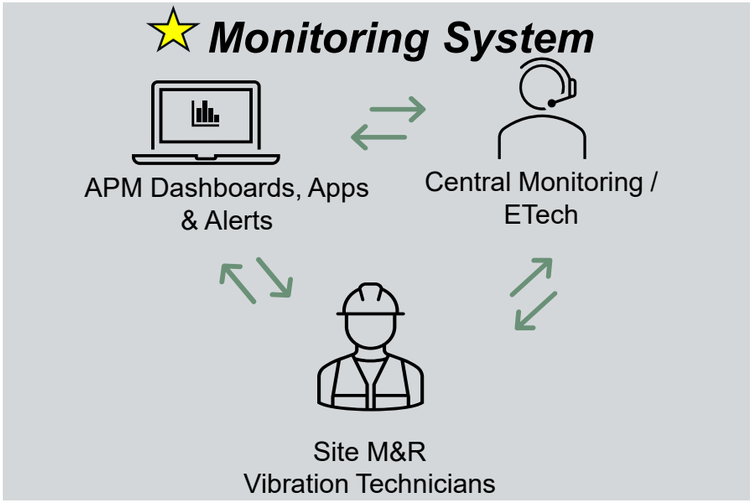
Wireless sensors are a cost-effective way to close the data gap

How does it all fit in together?



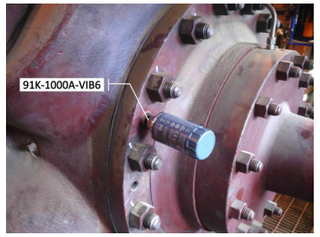
Analytics Workflow – How does Machine Learning fit into the picture?

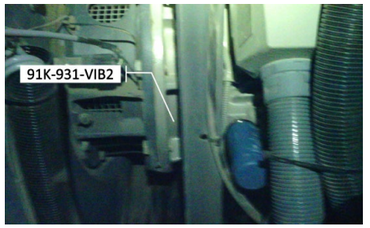


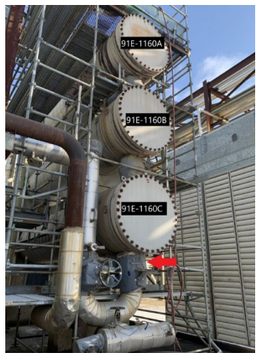


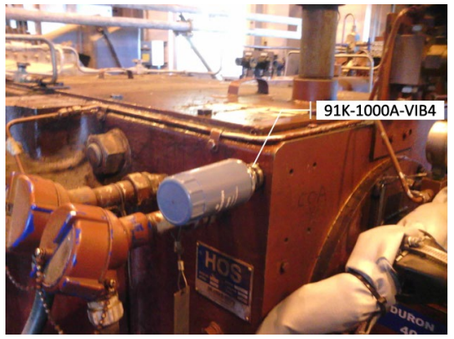
Status at a glance

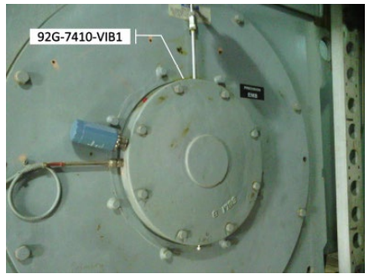
- Deployed ~3,800 wireless sensors across 9 operating sites
- Over 2,700 individual cases where benefit has been derived through Maintenance Cost savings and / or Lost Opportunity Value avoidance. This has resulted in substantial cost savings.
- Limiting maintenance techs from **potential line of fire and safety hazards**
- Freeing maintenance supervisors to direct work to more critical value-added work.
- Completed project and in sustainment.

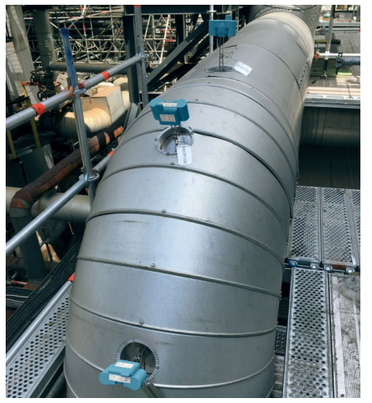


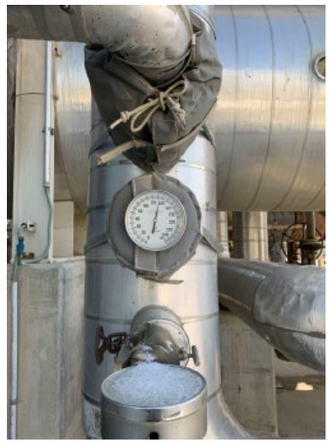






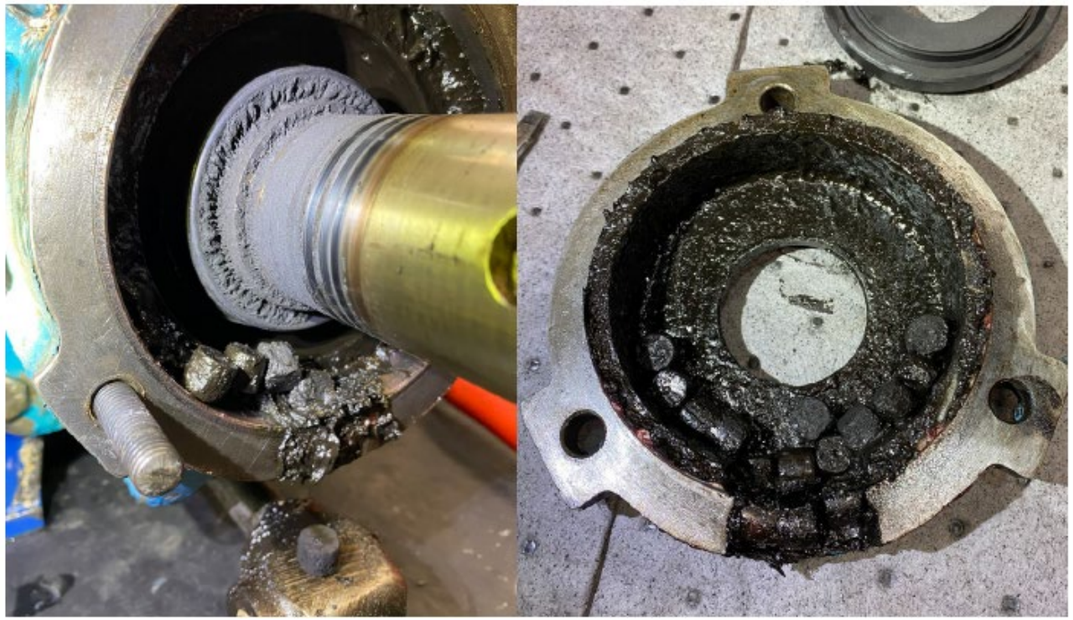



Example cases – fixing a bad actor

Example of Bad actor pump

This unit had been identified as a bad actor since it was installed in 2008 with average MTBR of < 1 year. Failures has been combinations of bearing and seal failures.



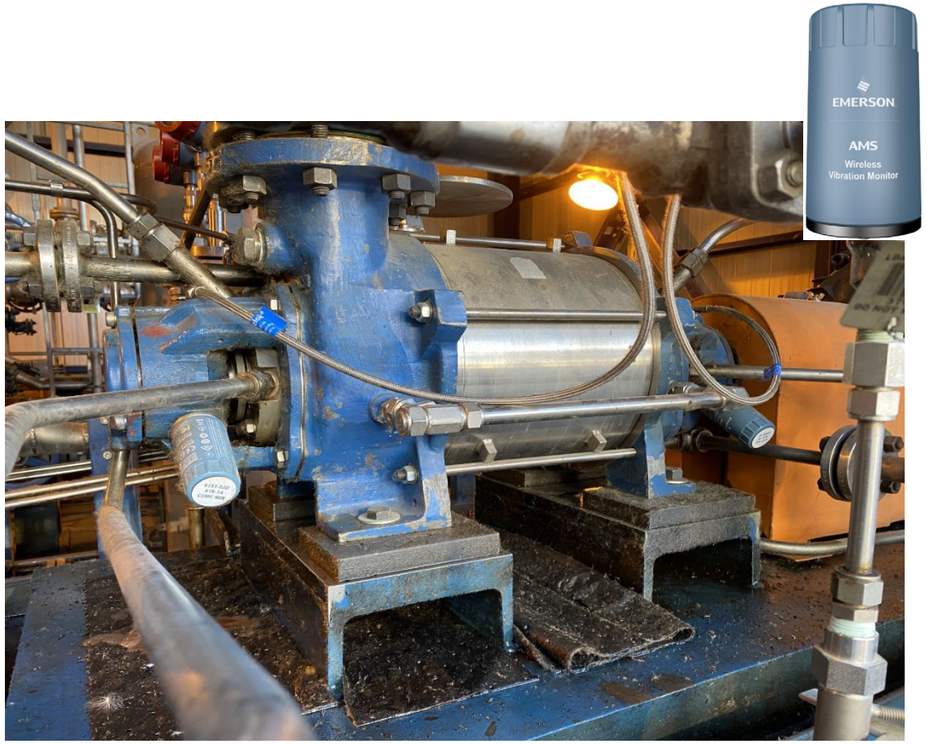
Prior to the wireless sensor utilizations, we implemented **bearing skin temperature monitoring in operator rounds**. However, it was still not timely enough to prevent failures from re-occurring. Bearing temperature fluctuates significantly with dynamic process conditions.

We needed **increased data frequency** of vibration and bearing temperature to understand and prevent the catastrophic bearing failures.

Focused Implementation Project

Request:

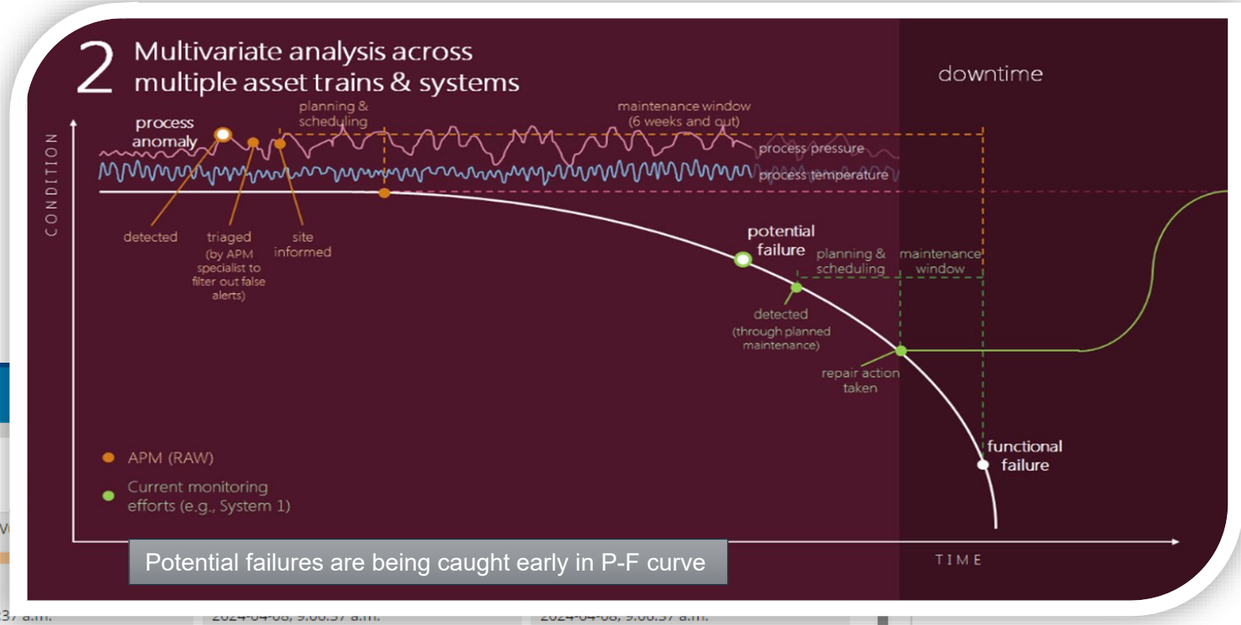
- The refinery reached out to the project team to implement vibration/temperature monitoring. The project was implemented on an expedited timeline and was configured to monitor the data for use in troubleshooting and condition monitoring.
- Later, since the network was setup, we have also implemented wireless discharge pressure gauge for troubleshooting purposes.

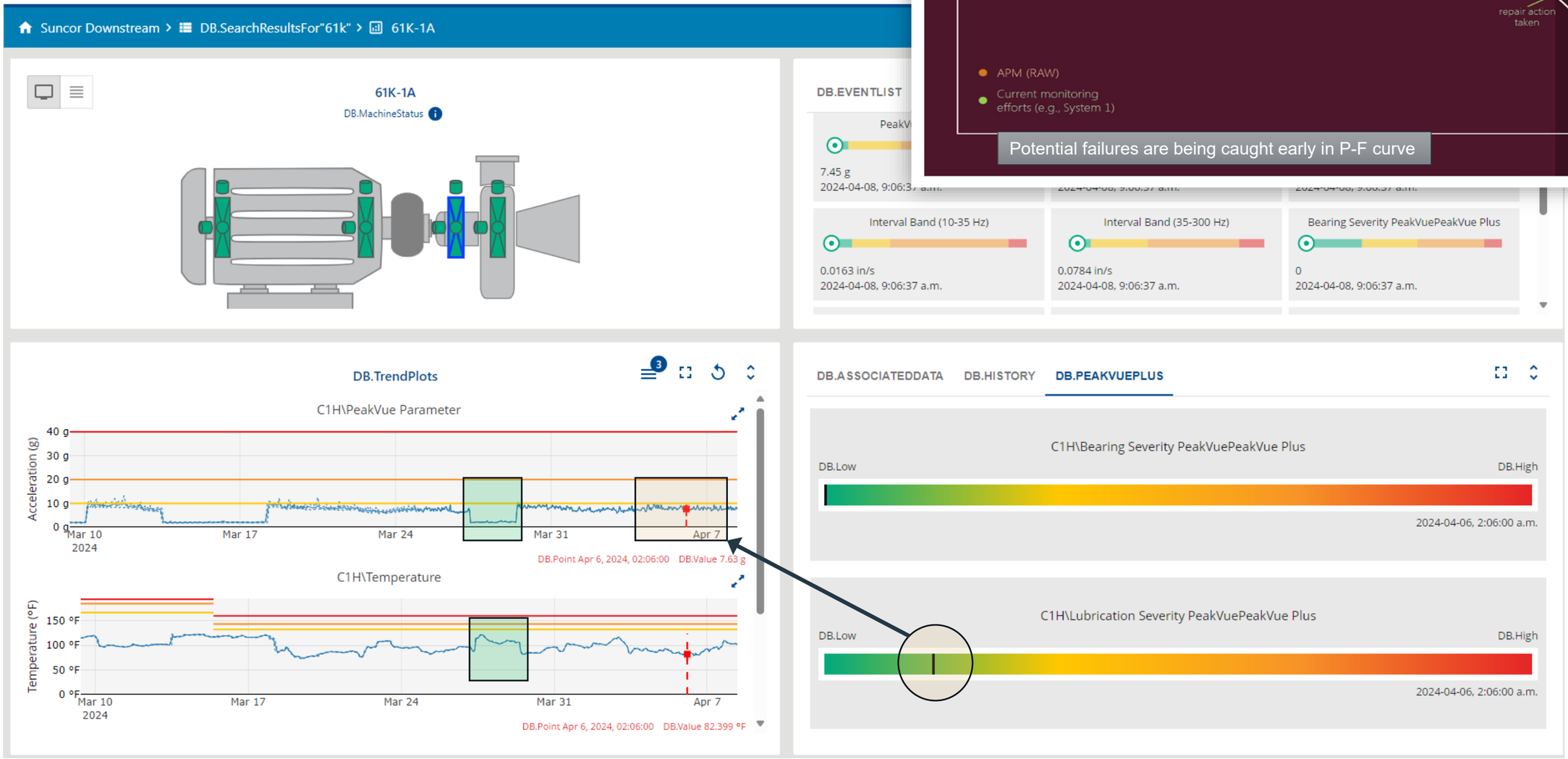


What changed because of this project

- **Continuous vibration, temperature, and pressure data** integration with **Machine Works** and SEEQ to analyze against process stream was a critical step that has made a big difference in optimizing, and condition monitoring of the asset to **minimize the risk**.
- **We have not had bearing failures since various improvements** and optimizations were made utilizing wireless sensors, and continuing to utilize for condition monitoring to-date.

AMS Machine Works





Example cases – extending to heat exchanger fouling

Wireless TI's to calculate HX fouling

What happened?

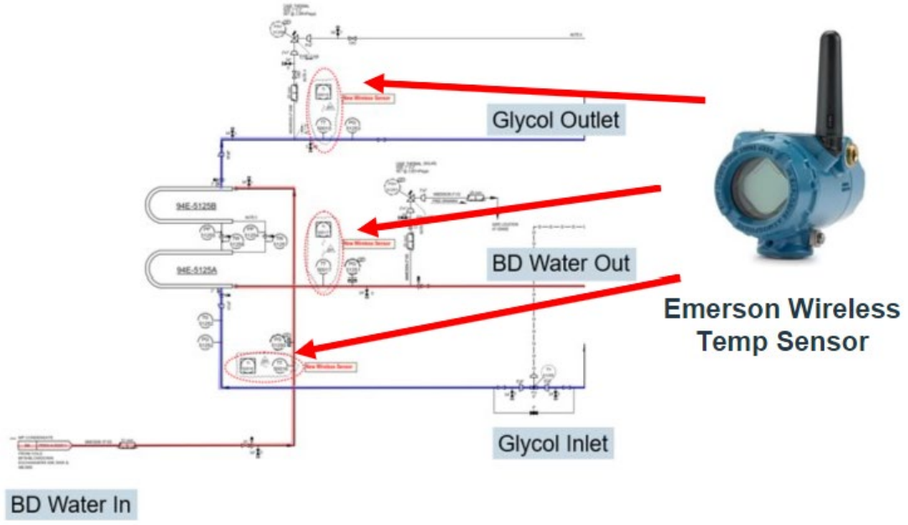
As part of the APM (RAW) Program, wireless temperature sensors were installed at one of our facilities. This allows continuous monitoring of heat exchanger performance and early detection of tube fouling.

The Exchangers use glycol to cool OTSG/HRSG blowdown before it combines with feed to the Warm Lime Softener. The water has a temperature limit and if the blowdown gets too hot, the plant must reduce flow, resulting in lower steam and bitumen production.

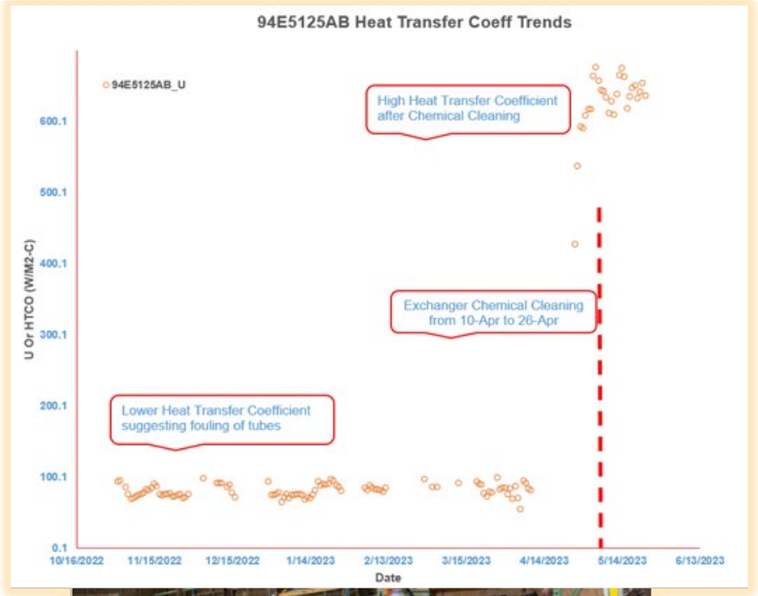
The sensors and associated models showed that we were losing heat transfer efficiency. At the time this was not a problem, colder months.

However, it was also calculated that if the exchanger was not returned to it's design condition (through cleaning), the plant production capacity could be reduced once spring arrived.

This was used to justify cleaning which resulted in a substantial LOV saving.



94E-5125AB Three (3) New Wireless Temperature sensors - Location



Model showing Exchanger Efficiency before & after cleaning

Impact of case

Loss avoided due to continuous monitoring capability of temperature:

New data and continuous trending allowed for quick detection and analysis of the loss of performance and determination of the solution.

Key takeaways

- Wireless sensors provide new and valuable data
- Live, accessible, and trusted data combined with quick decision-making generates results
- Follow the data and act decisively

May 2023

Summary

Summary

- Wireless sensors provide a cost-effective way of closing the data gap due to:
  - Substantially lower installation cost (e.g. avoid scaffolding costs, pulling cables, etc.)
  - Separate enterprise OT network aligns technology across different sites and makes scaling easier
  - Streamlined Engineering Execution Model
- Data brought in by wireless sensors enables the central reliability team to effectively work with sites and apply their expert knowledge in the right areas e.g. vibration analysis etc.

The Value of Partnership

- Having the Emerson Impact Partner - Spartan Controls partner with us in execution ensured prompt resolution to technical challenges and a key source of subject matter expertise to ensure best practices were followed.
- Pre-configuration of equipment and tagging by Spartan Controls drastically reduced field commissioning time and QA issues
- Support for inventory management helped ensure the project stayed on schedule during challenging times
- High Quality, Fit-for-Purpose Training and Field Support

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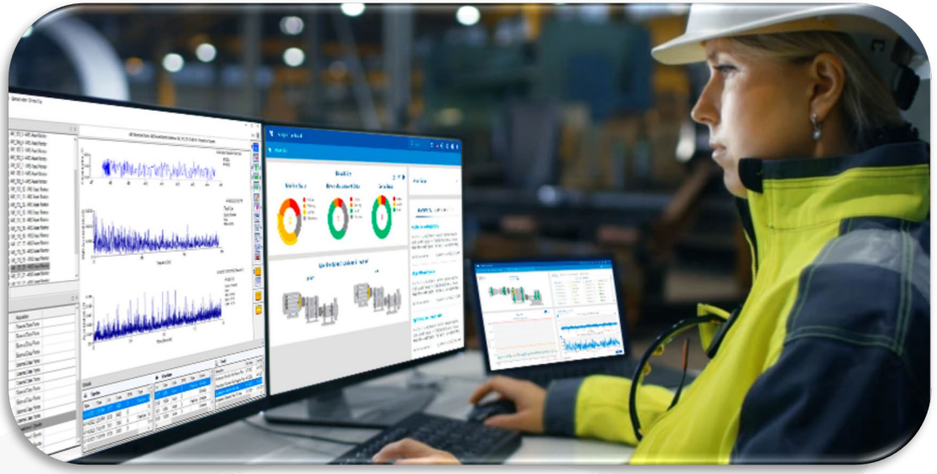
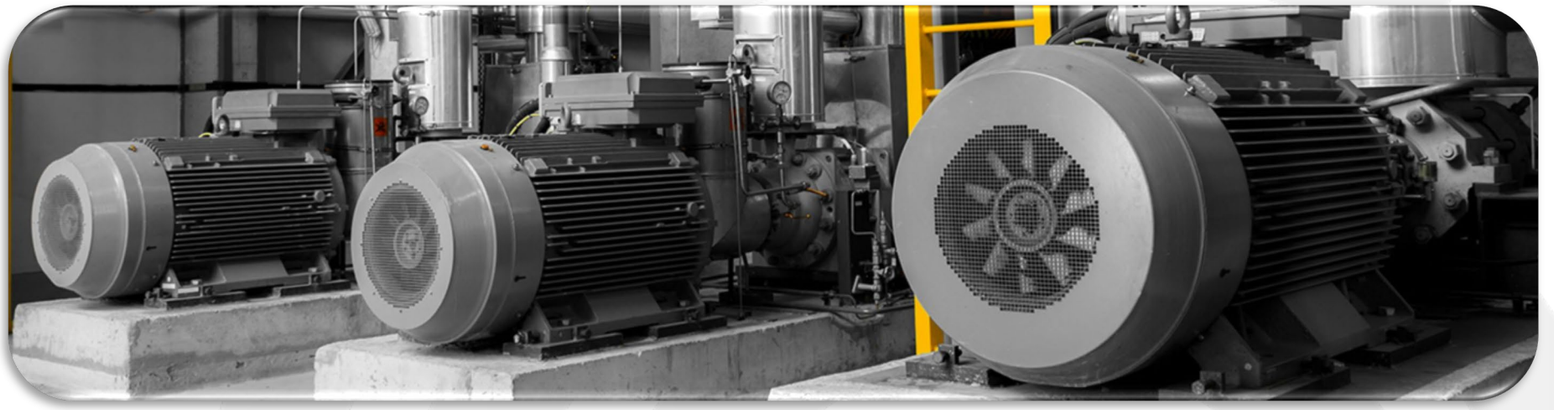
Partnership with Spartan Controls

SPARTAN CONTROLS

User Requirements

- The Initial scope was focused on hardware and software mostly.
- After the first initial meetings though it was identified that a project and services team could help scale the solution more rapidly.
- This included a Project Manager, Coordinator, Procurement and Materials handling team
- Instrument and Mechanical technical services were required to support field walkdowns.





Pervasive Sensing is the Foundation for Establishing the Needed Measurement Points

AMS 9420

Wireless Vibration/ Temp

- Hard to reach Vibration monitoring of rotating assets
- 120C Sensor Temp Rating

AMS 9530

AMS Wireless Vibration Monitor

- Tri-Axis Vibration Monitoring
- Cl I, Div 1 / IP66 /
- PeakVue, Spectrum, Waveform and Analysis Parameters

Corrosion / Erosion

- Unique and patented waveguide and EMAT transducers
- Intrinsically safe (Class1 Div1 / Zone 0)

248 Temperature

Accurate Wireless Temperature

- True wireless, remote measurements
- SmartPower™ module provides up to 10-year maintenance-free operation

Wireless Pressure Gauge

Helps To Eliminate Manual Rounds

- Rosemount™ Pressure Sensor in a gauge
- Significantly safer and more reliable than a Bourdon Tube

Monitoring Goal

Past Strategy

5 years

APM (Asset Performance Monitoring)

Manual Monitoring

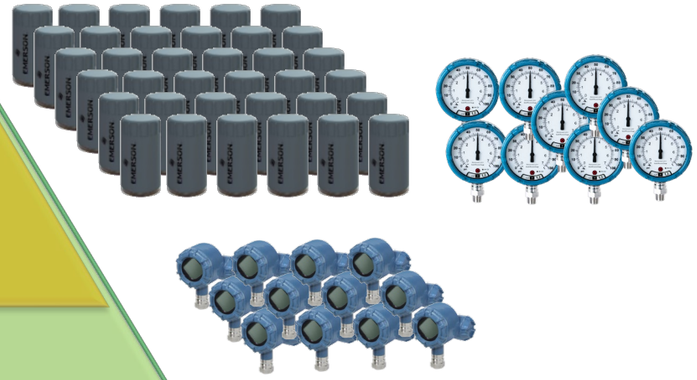
Online Protection Racks

Online Protection Racks

Automated Monitoring

"Routes by Inspection"

Small targeted deployments on Bad Actors or 4-20mA vibration transmitters with many different technologies



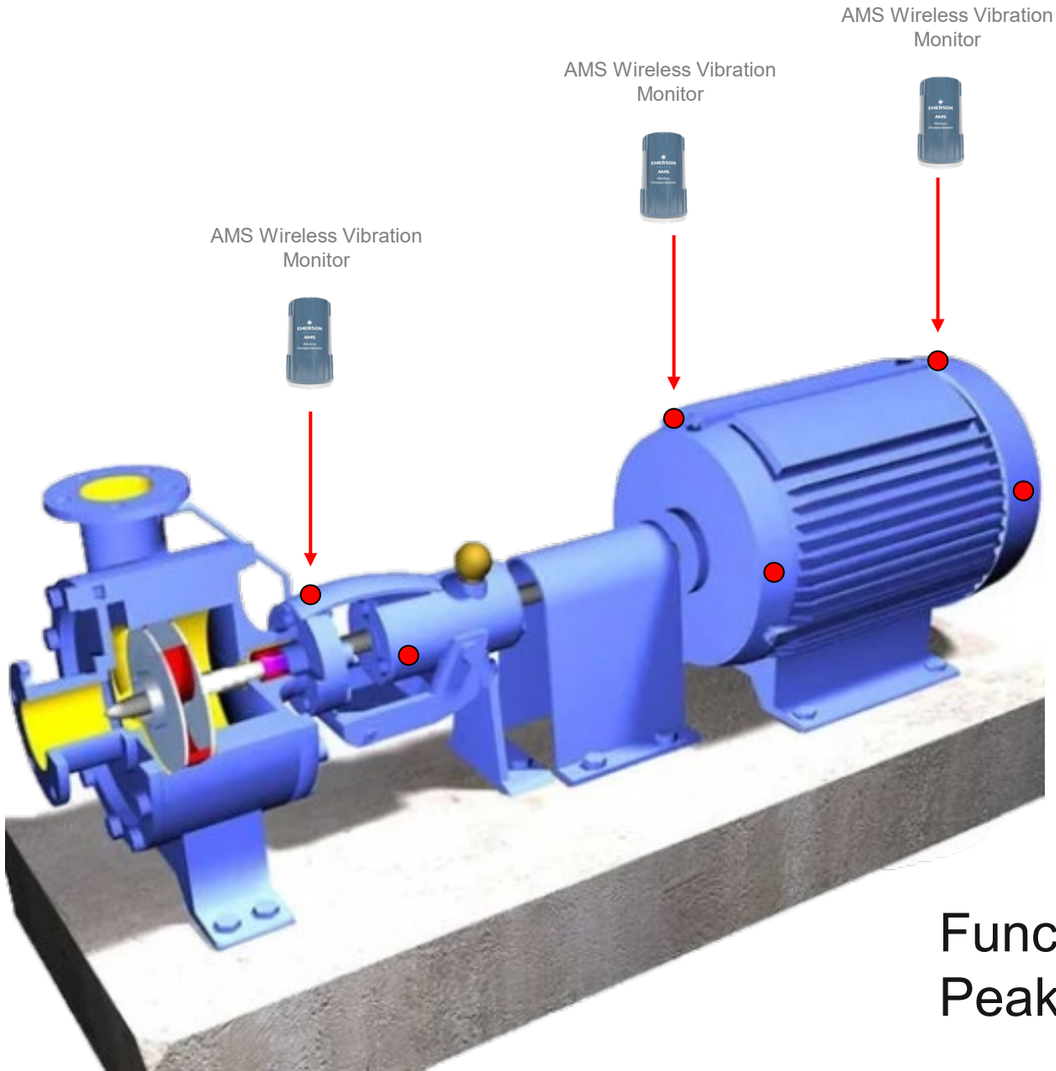
"Routes by Exception"

Project support for Conceptual Engineering, Scope Execution and IT/OT Architecture Support

- Overall Project Manager to oversee.
- Conduct site visits with Field Walkdowns
- Support selection of vibration monitoring points and orientation on rotating equipment in scope
- Support client to gather field engineering data requirements and conduct constructability reviews
- Support detailed engineering and execution cost estimates
- Field sensor installation support, field tagging, Wi-HART provisioning and commissioning where required
- Support configuration of assets in AMS-MW with wireless sensors

APM Project RACI Matrix - Rev. 1	Suncor	Spartan Controls	Other Impact Partners	Emerson
R - Responsible A - Approve C - Consult I - Informed				
Project Activities				
PROJECT MANAGEMENT				
Produce / update Project Master schedule	R	C		
Produce / update Construction Master schedule	R	C		
Develop and manage sub-contracts	C	R		
Develop and issue status reports	C	R		
Manage project staffing	R	C	C	
Manage project budget, invoicing and change order process	C	R	C	
PROCUREMENT				
Procure Emerson Hardware, Sensors Vibration Monitors (AMS 9530)	A	R		I
Procure Emerson Rosemount Hardware, Sensors Temp Monitors (248T)	A	R		I
Procure Emerson Rosemount Hardware, Sensors Pressure Monitors (WPG)	A	R		I
Procure Emerson Permasense Hardware, Sensors Corrosion Monitors (ET210,WT210)	A	R		I
Procure Emerson Software for AMS Machine Works (Option)	A	R		I
Procure Emerson Software for AMS Device Manager (Option)	A	R		I
Procure Gateway Cabinets and network equipment and cabling internal to cabinets	R	C	C	
Procure Fiber Optic and Cat5e network cables	R	C	C	
Procure Installation equipment (pipes, cable tray, wiring....etc.)	R	C	C	
Construction Package				
Demolition and Installation Plan	R	I		
Loop Sheets for Wireless Gateways and Transmitters (option pricing)	R	I		
Update Plot Plans, Location Drawings, Antenna Typical (option pricing)	R	I		
Power Request Forms and Modifications to Panel Schedule Drawings	R	I		
Elementary Drawings and Design (Electrical power, grounding, cable trays, circuits, power distribution...etc.)	R	I		
Update P&IDs for Pumps (option pricing)	R	I		
System Engineering				
References on Cabinet Arrangements and Power Circuits (as needed)	R			
Gateway Subpan and/or Gateway Enclosure Layout Drawing (as needed)	R			

Applications (Typical)



Location	# of Sensors
Motor	
Motor	1-2
Pump	
Pump	1-2

MECHANICAL FAULTS

- **ELECTRIC MOTOR**

1. **BALANCE**
2. **ALIGNMENT**
3. **LOOSENESS**
4. **BEARING FAULTS (PeakVue)**
5. **MOTOR FAULTS**
6. **COUPLING FAULTS (PeakVue)**

- **PUMP ROTOR**

1. **BALANCE**
2. **ALIGNMENT**
3. **LOOSENESS**
4. **BEARING FAULTS (PeakVue)**

Functions such as FFT, Energy in Bands, or PeakVue™ for analyzing the collected machine data

Field Verification Walkdowns (FVR)

- All site visits with findings reports
- selection of vibration, pressure, temp, UT, ultrasonic monitoring points and orientation on rotating equipment in scope
- selection of vibration, pressure, temp, UT, ultrasonic monitoring points and orientation on rotating equipment in scope
- support Suncor to gather field engineering data requirements and conduct constructability reviews
- Wi-HART sensor locations conformation

SPARTAN CONTROLS

Field Inspection Report

May 21, 2021
Record ID: 20008

102K-8290-VIB4 K-8290 COMP-COMP NDE VIBRATION

Created	Event Date	Spartan Contact	Customer Contact	Ref. WO/MOC	GPS Location	Asset criticality
2021-05-16	2021-05-10	Dillon Olchowy	Kurt Wentzell	--	57.233853, -110.849306	2B

Visual Integrity

Good

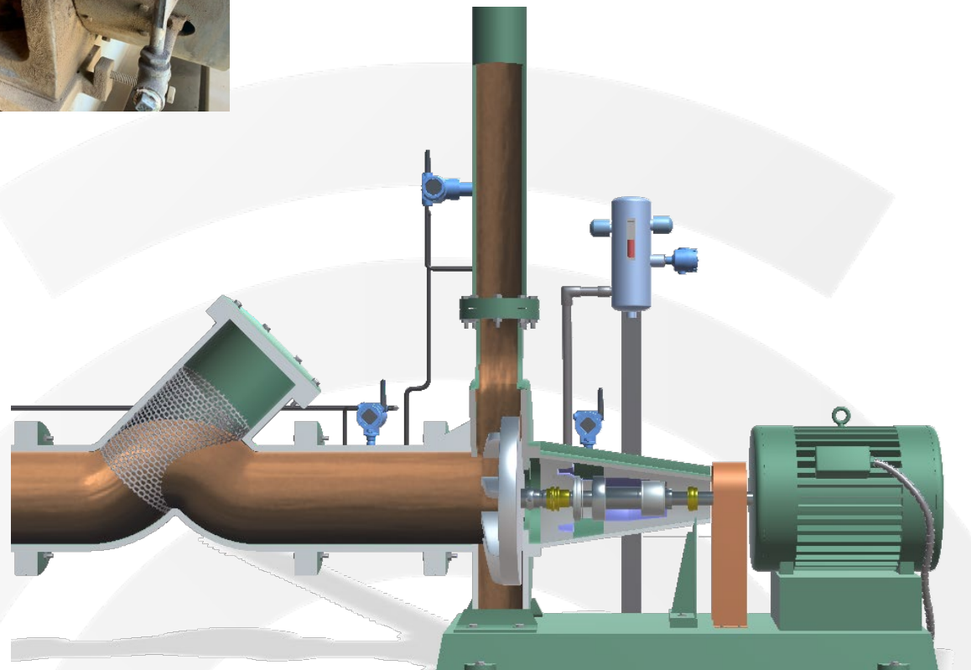
Report Card

- Environmental
- Health and Safety
- Installation
- Mechanical Integrity
- Obsolescence
- Tagging/Signage

Field Installation

- Depending on site resource availability, Spartan was deployed to help augment workforce to facilitate rapid execution.
- This included services to review technical documentation, remove surface paint and grease, epoxy mount pad, and final sensor mounting.

https://youtu.be/9pstuxkpxds



Inventory Management Service

- Spartan offered a service to centralize all APM material in the Edmonton warehouse. This provided a few benefits to the Suncor team:
  - Cost savings reducing overhead costs of storage space at Suncor facilities
  - Cost savings for labor to have client personnel manage inventory at specific locations (they don't use all stock at onetime)
  - Potential stock shrinkage savings (lost/misplaced goods)
  - Allowed for client to pre-order material to help neutralize supply chain constraints and help beat price increases
  - Added services of pre-configuration of material which allows for increased efficiency for client resources to avoid configuration in the field
  - Material comes pre-configured, organized and labelled ready for installation reducing onsite labour and potential lengthy shutdowns of equip

Software

Relevant Time ***Asset Monitoring***

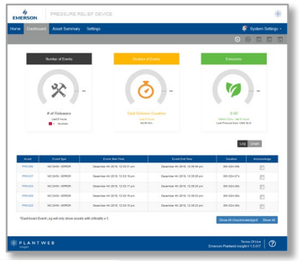
Abnormal Situation Identification

Pre-Packaged ***Analytics***

Seamless Integration

Minimal Configuration

Simple, ***Actionable Interface***



STEAM TRAP

Identify Steam Trap Failures Instantly

Acoustic

INLINE CORROSION

Inline Corrosion

Inline Corrosion Sensors

NETWORK MANAGEMENT

Wireless Network Management

All Wireless Gateways and Devices

POWER MODULE

Transmitter Battery Monitoring

All Wireless Gateways and Devices

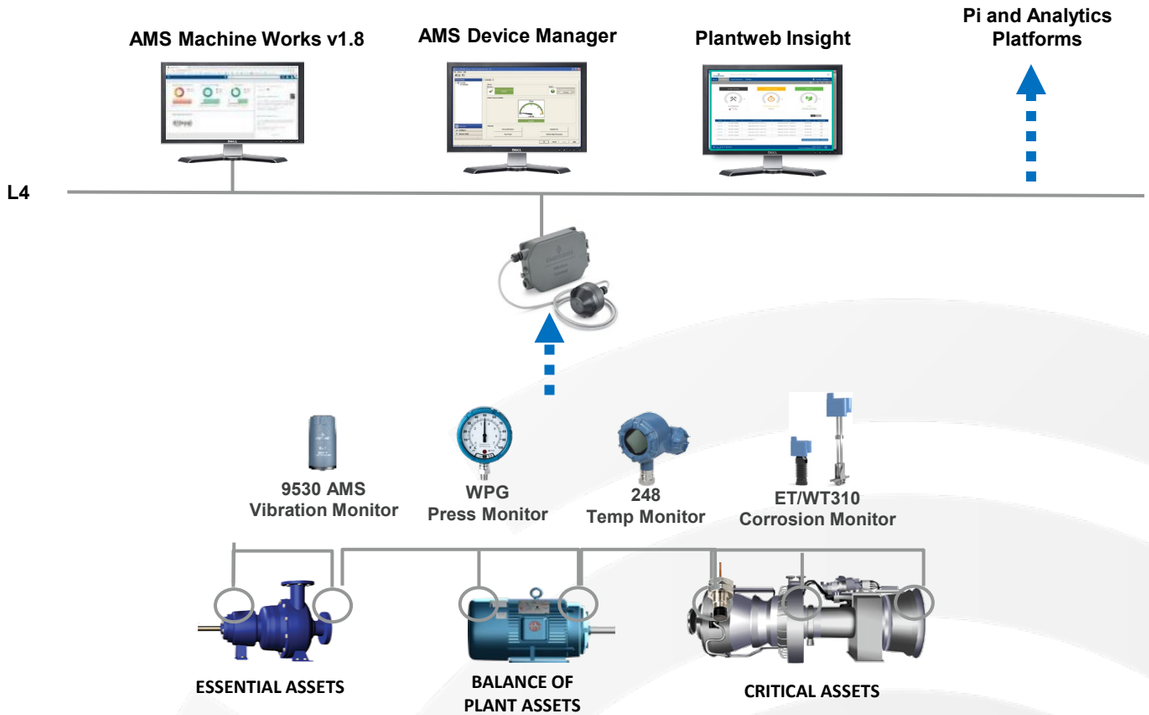
Plantweb Insight

AMS Machine Works

AMS Device Manager

System Architecture

- Consult on Suncor’s IT/OT architecture design for the scope
- Consult on resolution of Cyber-Security requirements outlined by Suncor
- Support integration where required of Wi-HART gateways with Wi-Fi access points
- Provide Wi-HART and gateway Subject Matter Expertise to Suncor’s “Connectivity Infrastructure Platform (CIP)”
- Support integration of AMS-DM servers with GE APM(Meridium)



Questions?

Find More Information

Contacts

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- Reliability Technical Sales / Spartan Controls

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Thank You