Reliability Centered Maintenance (RCM) w/ Reliability Strategies (RS) in Maximo Application Suite (MAS)

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With the right strategy, you can do the right maintenance…at the right time…for the right reasons.

IBM

Agenda

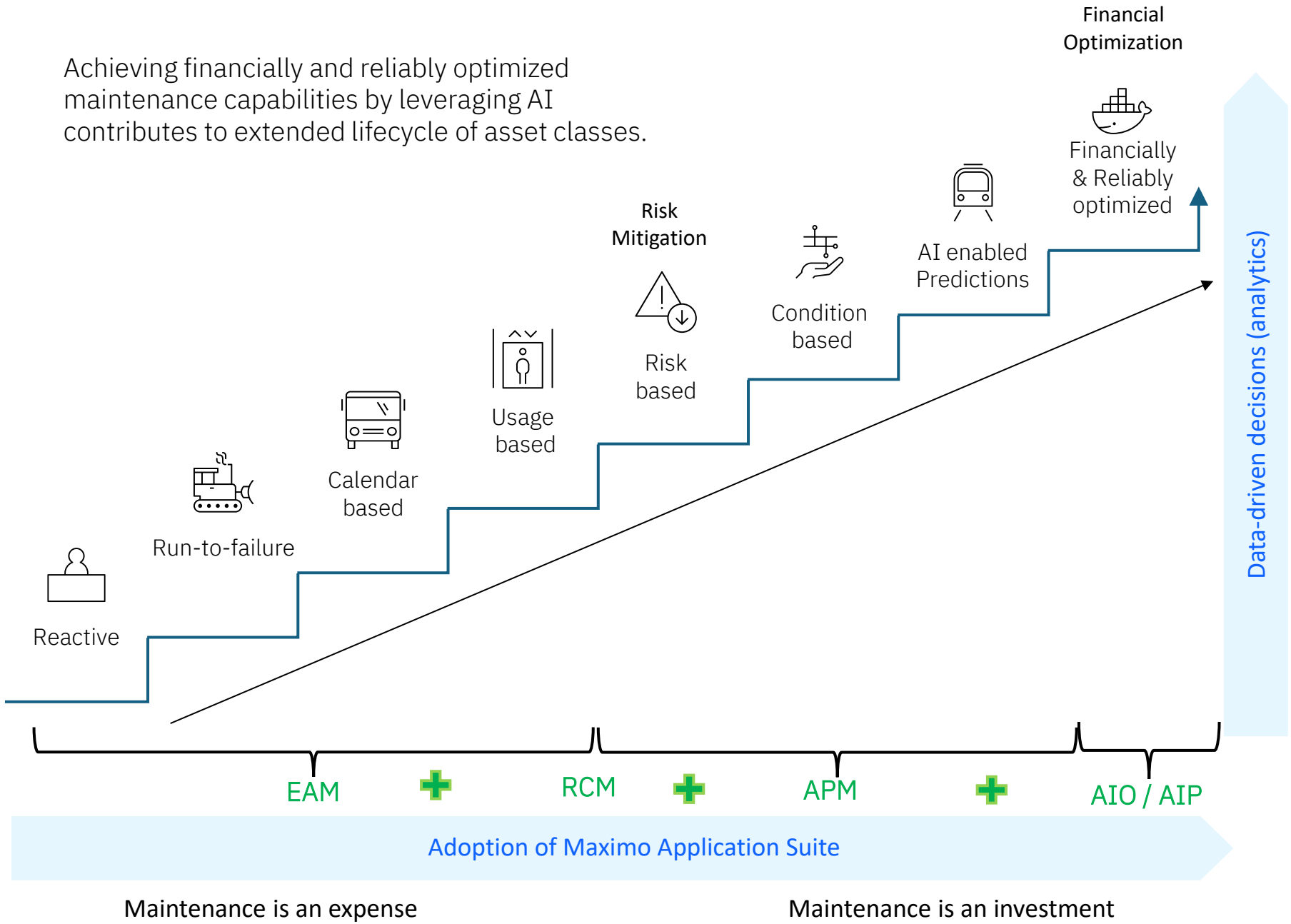
- Asset Maintenance Overview
- RCM Background
- Why is RCM important to our customers
    - Customer Example
- Challenges with RCM → Reliability Strategies
- Reliability Strategies Release Capabilities
- Watson FMEA Builder
- Overview of the Application (RS Library)

Asset Maintenance Strategies and Adoption of MAS

MAS delivers an integrated solution that addresses the full asset lifecycle for each of the asset classes in an organization.

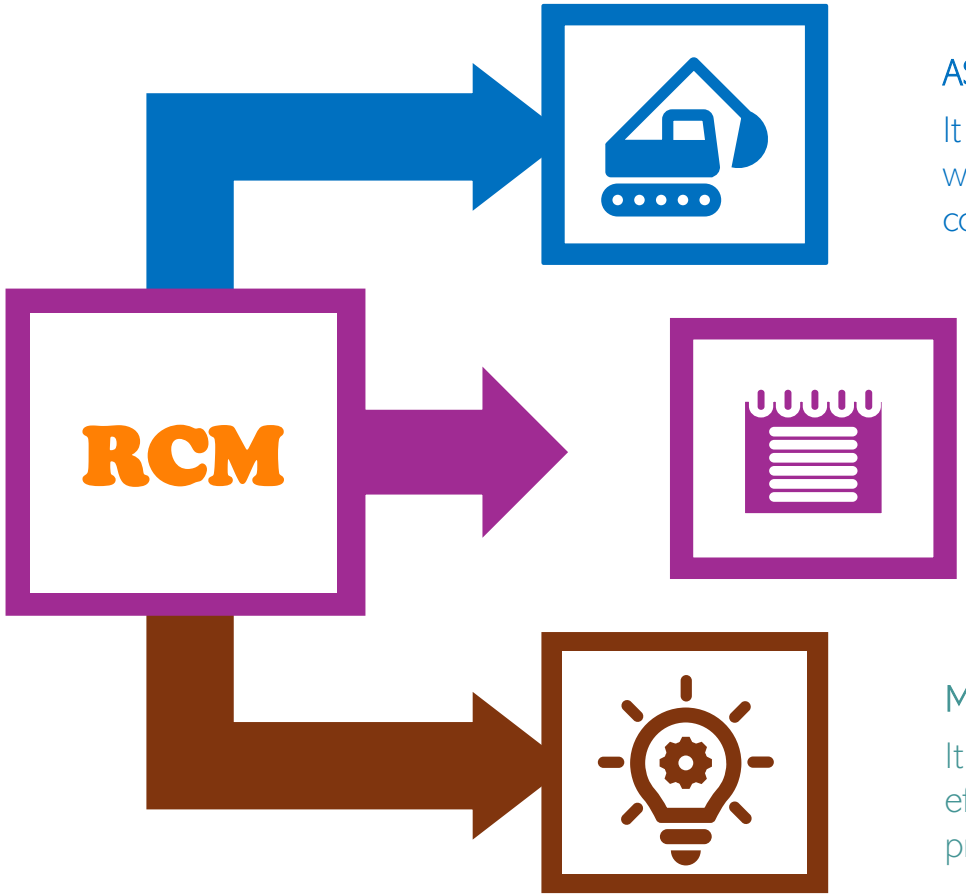
The asset strategy and MAS adoption journey depends on factors including operating context, criticality of asset, asset replacement cost and its impact of failure on safety, environment and operations.

Achieving financially and reliably optimized maintenance capabilities by leveraging AI contributes to extended lifecycle of asset classes.



Reliability Centered Maintenance: Background

An analytical & methodical process used to determine appropriate failure management strategies to ensure safe and cost-effective operations of a physical asset in a specific operating environment



ASSET MANAGEMENT

It is the process to ensure that assets continue to do what their users require in their present operating context, and throughout its lifecycle.

RELIABILITY

It represents tactics that maximize the asset's reliability and availability

MAINTENANCE

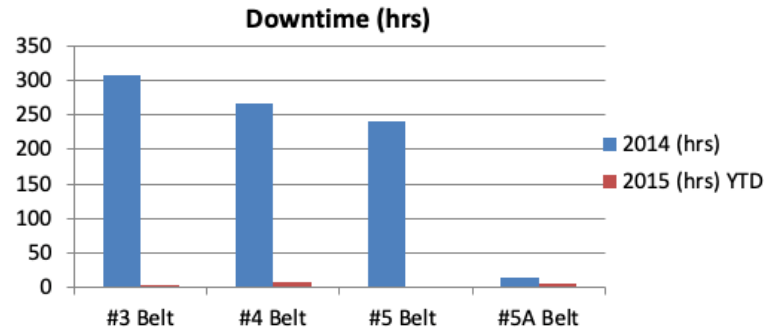
It is a structured process to develop an efficient and effective maintenance plan for an asset to minimize the probability of failure

Why RCM?

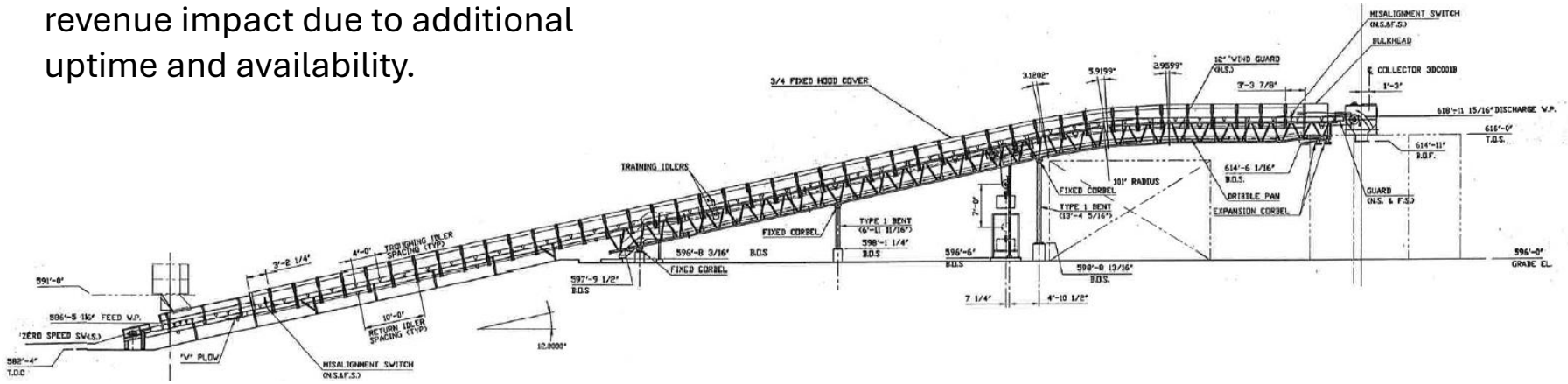
Why is RCM important to customers?

- One petrochem customer, applying RCM for one asset type, was able to:
  - Reduce repair costs by 44% ($678K) year to year
  - Reduce nonproductive downtime by 97% year to year, resulting in a **$60M** revenue impact due to additional uptime and availability.

Results in numbers: Costs/Benefits



	#3 Belt	#4 Belt	#5 Belt	#5A Belt	Total
Downtime 2014 (hrs)	307	267	240	14	828
Downtime 2015 (hrs) YTD	5	12.6	0.3	5.2	23.1
Cost reduction 2015/2014 %	36%	106%	69%	39%	56%



RCM is a proven methodology to identify the optimal maintenance strategy

With the right strategy, you can do the right maintenance…at the right time…for the right reasons.

Understand failure modes

- to shift from reactive to proactive strategy-based maintenance

Build custom FMEA (failure modes and effects analysis) studies

- to ensure all critical assets are covered

Identify failure consequences

- to mitigate safety and compliance risks

Optimize PMs

- to improve operational efficiency and extend asset life

Optimize asset performance

- to reduce downtime and increase revenues

So why is RCM not widely implemented?

Very Time Consuming

Studies are time consuming and require all the best people to be offline

Highly Resource Dependent

Takes considerable man-hours that would have been otherwise spent on maintaining equipment

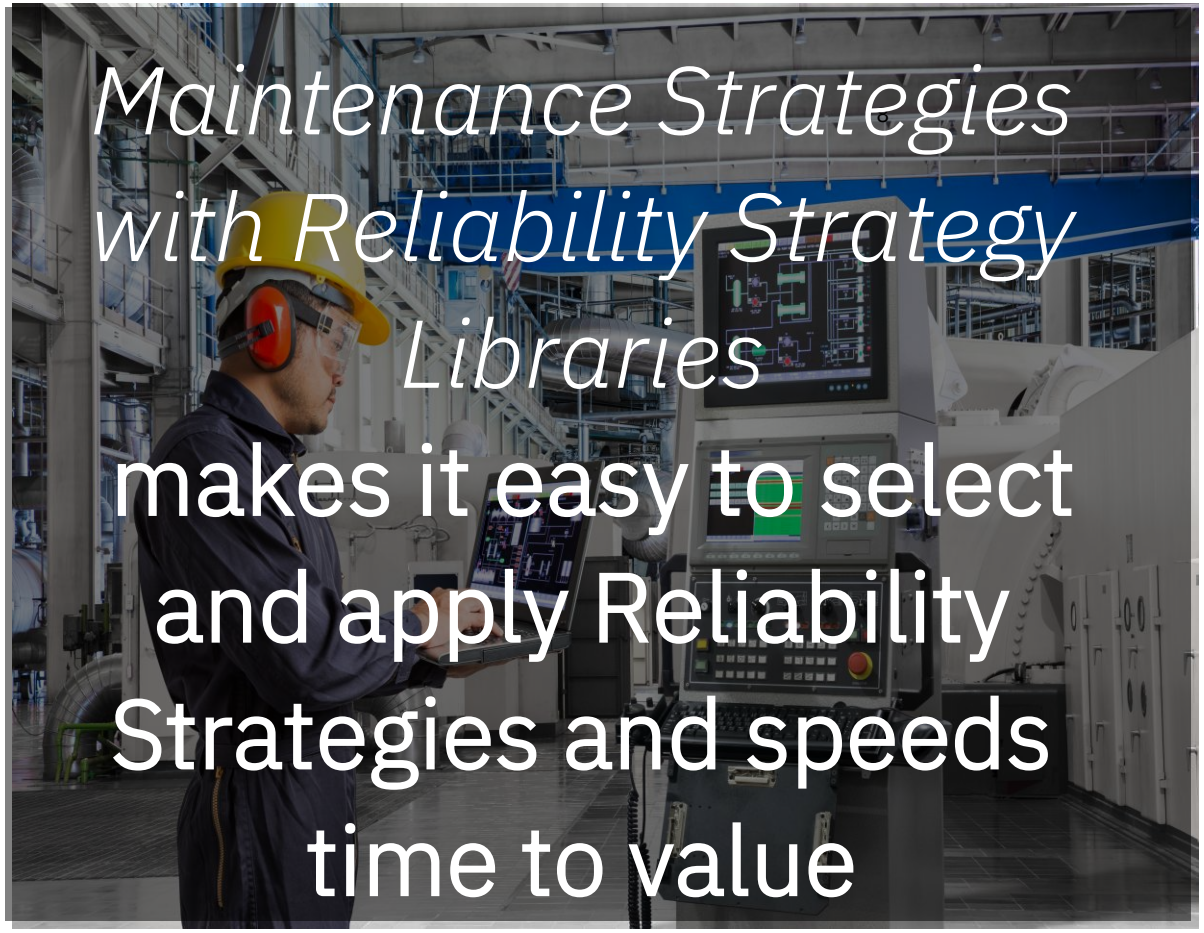
Lack of Data Availability

Data availability and disparate systems make conducting the study and implementing the actions difficult

Scaling RCM is difficult

Scaling RCM based methods, integrating systems and leveraging standardize data across sites is costly or just doesn't happen

Introducing "*Reliability Strategies with Reliability Strategy Libraries*"



A dedicated RCM/FMEA application with included library. Together, it becomes a game-changer with rapid time to value.

Challenges

We have struggled w RCMs in the past

"RCM studies take forever, and tie up our resources for weeks"

IBM Solution

Value based strategies out of box

- 75% faster than traditional RCM studies
- 20% decrease in maintenance $

Reliability Strategies Release Capabilities

With rapid time to value, the solution makes it fast and easy to create, apply and optimize reliability strategies

”Composer” - 8.11

I want to “apply” RCM studies, and get the benefits without doing all the work

- I can select which assets, asset types and configurations from the library that I want to apply
- I can understand the boundary conditions of the assets
- I can review the FMEAs in the Library and understand their effectiveness
- I can quickly make changes based on operating context
- I can rapidly build PMs and job plans using the library
- I can easily scale across my organization

“Builder” - 9.0

I want to “complete” RCM studies and get the benefits without doing all the work

- I can copy and or modify existing FMEAs to better suit my business needs and assets
- I can prioritize my actions I want to take based on Risk Priority Numbers
- I can apply my completed actions for one-to-many assets
- I can assign and track actions taken and follow-up
- I can upload my existing FMEAs for easy reuse across the enterprise *
- I can use watsonx to rapidly generate new FMEAs **

New Capabilities That Are Available for the Reliability Strategies 9.0 Release*

“The Builder”

RS “Application”

- As a Customer Reliability Engineer, **I can create new and or copy/edit FMEAs or import my own**
  - I can complete an RCM **Study Overview**
  - I can apply/create/edit Failure Modes and apply **Mitigations** based on **Risk**
  - I can select, assign and track the status of **Actions**
  - I can **import my own studies**

RS “Library”

- Content/Database Reengineering – **“Component based Architecture”**
- **New Assets in the Library**

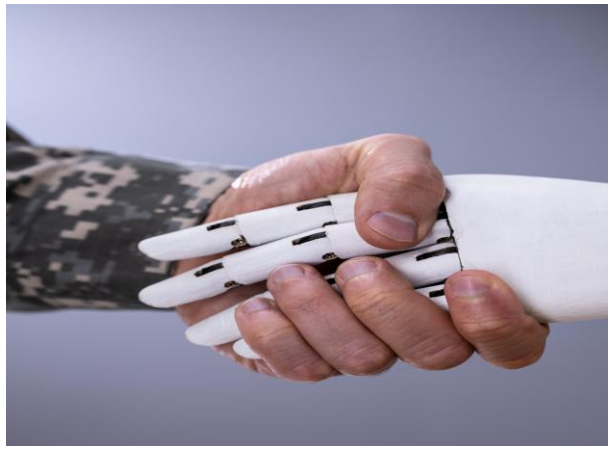
RS powered by “watsonx”

- Tech Preview with IBM Research - Watson X FMEA Builder: Using Watson X a Reliability Engineer **I can create new FMEAs with Watson X** that can be approved and added to the Library.
- **Active POC’s with customers**

Assets & Components linked to 58,000 failure modes and growing

Watson FMEA Builder

- Think of the FMEA Builder as a highly trained personal assistant, like one hundred 30-year veterans, to help you build and apply FMEAs.



90% Faster than traditional RCM/FMEA methods*

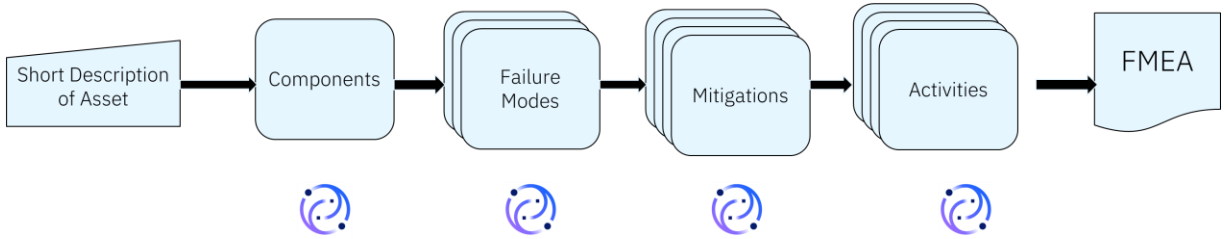
Customer Polling (300 Participants) – Product Market Fit:

- 47% use Gen AI (Chat GPT like solution) outside of work
- 35% current use Gen AI (Chat GPT like solution) at work today

✓ 82% would use an IBM Gen AI FMEA Builder solution if it was available today (will be available in 9.1)

✓ Of the above, 59% said they would like the use the IBM Gen AI FMEA Builder as a "trusted supervisor" to build FMEAs

User-guided creation of FMEAs, step by step with generative AI.



* Based on actual Sponsor User case studies of traditional methods vs the use of the watsonx FMEA Builder

Reliability Strategies Library Overview

Asset: Heater

Asset type: Electric

Asset configuration: Heater - Liquid - Electric

Get strategy

Overview | Failure modes | Mitigation activities

Strategy details

Failure modes
17

Mitigation activities
4

View failure modes

View mitigation activities

Boundary

The boundary of a Heater: Electric, Liquid type for the purpose of this database is defined to include the following:

Includes

- Heater
- Power cable and connection
- Thermocouple
- Heating element
- Control cabinet (cabinet and purge air only)
- Insulation

Excludes

- Piping
- Power supply

Asset: Heater

Asset type: Electric

Asset configuration: Heater - Liquid - Electric

Get strategy

Overview | **Failure modes** | Mitigation activities

- Control Cabinet
- Control Cabinet Magnehelic Gauge
  - **Failure mechanisms (2)**

How the failure occurs. A mechanism is similar to a problem failure code.

  - Out of adjustment
- Control cabinet
- Heater Shell
- Heating Element

Overview | Failure modes | **Mitigation activities**

Operating context

Preview activities in all contexts

Criticality
- (•) Critical
- ( ) Minor

Duty cycle
- (•) High
- ( ) Low

Service condition
- (•) Severe
- ( ) Mild

Activities	Frequency
Inspection	2Y
Performance Monitoring	3M
Operator Rounds	1S
Thermography	1Y

Inspection

Preventative maintenance (PM) details

The objective of the Inspection task is to ensure that the heater is in good working condition and is available for plant startup.

Frequency
2Y

Labor hours
8.00

Job plan details

Inspection should, as a minimum, include:

- Check for leaks on valve, piping or vessel
- Repair leaks, tighten bolts or replace gaskets as necessary
- If provided, check differential pressure on filter elements, drain liquid out of filter vessel, and clean
- Verify calibration and function of instrumentation
- Check and tighten all electrical connections, make sure they are tight, free of oxide build up and that no dust or oil is present
- Inspect all fuses for proper amperage and voltage
- Check integrity of wiring and insulation
- Check inside of electrical enclosure for rust, dirt or dust. Clean as necessary. If moisture is present replace gasket and ensure cover seals tightly
- Liquid immersed units should be removed from vessel and checked for scale build up and cleaned as required
- If the heater is removed or tightened, take care to orient the heater in the position it was originally oriented
- Be sure to calibrate the Magnehelic Gauge
- Inspect insulation (if visible) for damage or loss)

The craft instruction should be developed using the rows below, which consist of the Failure Locations and Degradation Mechanisms for which this task is expected to be reasonably effective. This is a complete list of the degraded states for which the task may provide some mitigation, the degree of which will depend on other factors, e.g. task interval compared to wearout time, and the wearout time itself.

- Should address: Control cabinet for: Gasket or seal failure
- Should address: Control Cabinet Magnehelic Gauge for: Drift