

# Monitoring at Scale With Seeq

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PROCESS & EQUIPMENT MONITORING LEAD FLINT HILLS RESOURCES **Brian Schriever** 

PROCESS & EQUIPMENT MONITORING ANALYST FLINT HILLS RESOURCES

#### Flint Hills Resources – Who Are We?

FLINT HILLS

Flint Hills Resources is a refining company with operations primarily in the Midwest and Texas

Based in Wichita, Kansas Subsidiary of Koch Industries We produce fuels & aromatics Gasoline, Jet Fuel, and Diesel Asphalt ~3,000 employees





#### Flint Hills Resources: Monitoring Capability Overview

Utilize automated anomaly detection for early identification of process and equipment anomalies to enable profitable action

Our vision is to monitor all equipment & processes, not just specific assets







## Challenge #1: Widescale Pump Vibration Monitoring



#### Challenge #1: Widescale Pump Vibration Monitoring

Executed plant-wide pump wireless vibration projects, resulting in thousands of vibration sensors being installed

Wanted to implement an automated solution to monitor all of the readings with similar univariate techniques

Attempted solutions in Excel, ML, and Seeq (Tree Maps), but was slow and still required a lot of manual review

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#### **Widescale Pump Vibration Monitoring**





**CHALLENGE** 

Deploy univariate monitoring on thousands of new wireless pump vibration sensors



Develop a monitoring solution in partnership with Seeq that harnesses asset groups for scaled deployment



RESULTS

Quick implementation of thousands of vibration monitoring models, and a new monitoring solution integrated into Seeq!



Solution #1:

 Test Manager to quickly mass implement univariate models on data in asset groups
 Alert Manager as the user interface for

• Alert Manager as the user interface for screening of model alerts

• Asset Group Builder to build asset data groupings for large amounts of equipment

Partnered with Seeq to develop three custom add-ons:

**Automated Anomaly Detection Solution** 







#### Solution #1 – Asset Group Builder



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#### Solution #1 – Test Manager







#### Solution #1 – Alert Manager



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	Y_velocity_ZScoreLimit_	E0310P101B_Inboard_Bearing-RP	1	06:47:07	2023-03-30 07:56:52 AM	2023-03-30 02:44:00 PM	
	Z_Velocity_ZScoreLimit_	07GBM780_Outboard_Bearing-RP	1	20:23:43	2023-03-30 07:00:59 AM	2023-03-31 03:24:43 AM	
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	Y_Velocity_FHR_ForecastLimit_Fixe_Limit_	40GA158A_Inboard_Bearing-RP	5	24:24:59	2023-03-30 03:00:00 AM	2023-03-31 03:24:59 AM	
	Z_Velocity_ZScoreLimit_	E23P114B_Outboard_Bearing-RP	1	08:36:57	2023-03-30 06:44:00 PM	2023-03-31 03:20:57 AM	
	X_Velocity_ZScoreLimit_	E41FM1A_Inboard_Bearing-RP	1	10:06:56	2023-03-30 05:14:00 PM	2023-03-31 03:20:56 AM	
	Z_Velocity_ZScoreLimit_	26GA2621B_Inboard_Bearing-RP	1	19:08:26	2023-03-30 08:14:00 AM	2023-03-31 03:22:26 AM	
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#### **Results #1 – Monitoring at Scale!**



Able to quickly deploy and monitor a large number of models on assets with similar monitoring strategies

Visualize findings for documentation and communication

The development of Asset Group Builder informed the first release of Seeq "Asset Groups"



## Challenge #2: Improved User Experience



#### Challenge #2: Improved User Experience

Solution quickly expanded to be used for other more complex models outside of pump vibration

Large growth in usage led to recognition of opportunities to improve the Alert Manager

- Slow loading times
- Notes were difficult to access and update
- Suppression on or off only, no reset criteria
- Inefficient when screening many alerts

Partnered our solution superusers together with Seeq developers to improve the experience





#### **Improved User Experience**





**CHALLENGE** 

Improve the speed and capability of the monitoring solution's alerting interface



Partner with Seeq to improve through user learnings, feedback, and usability testing



RESULTS

Easy-to-use interface that is more efficient and comprehensive for screening alerts!



#### Solution #2: Prototypes & Usability Testing



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#### Solution #2 – Evidence Manager







#### **Results #2: Greatly Improved interface**



#### Fast!

Enhanced note taking capability

Logic-Based Suppression (time-based and condition-based)

Model categorization options

Enhanced table functionality and customization

QuickTrend for more efficient screening

Currently monitoring 38,000+ unique variables on 4000+ assets!

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### **Project Team**

#### Seeq

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#### **Flint Hills Resources** Chris Chrisman Jason Heier **Brian Johnson** Chad Lane Lindsey Sheffert Lee Donelson Ben Bernal Nick Walker James Clark



# Thank you

