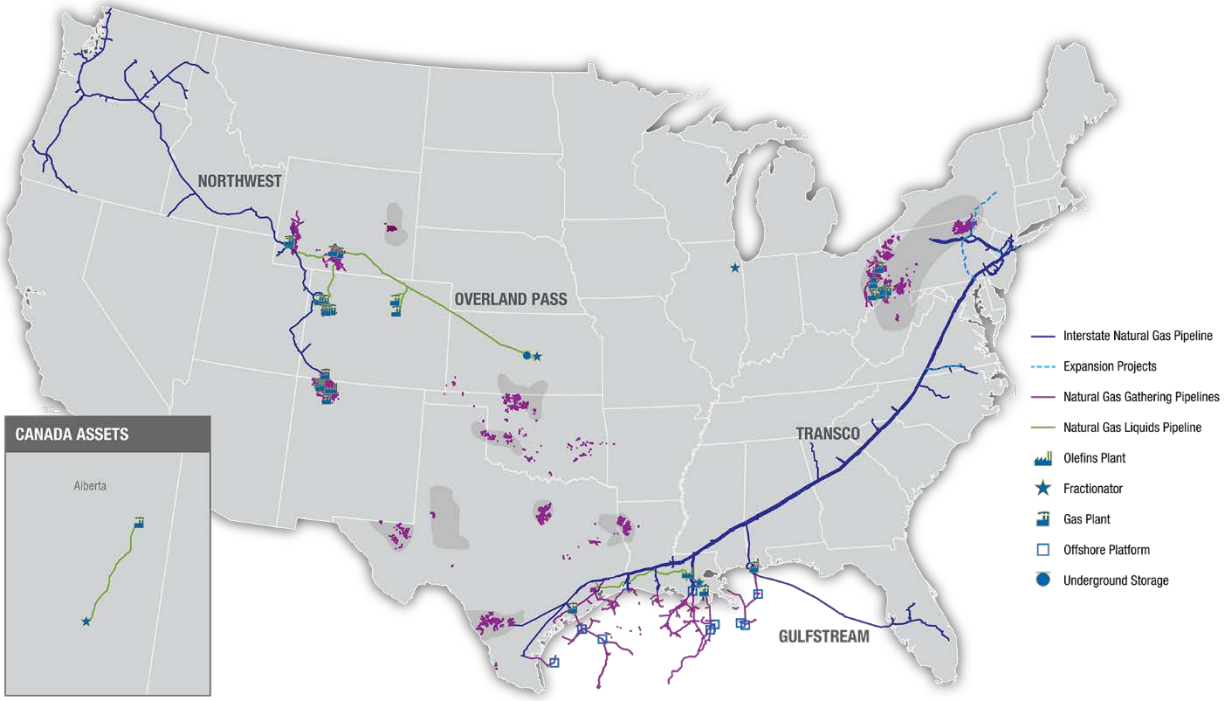
Engine Burn Time Analysis

for Environmental Compliance

Presented by **Mark Nealis**

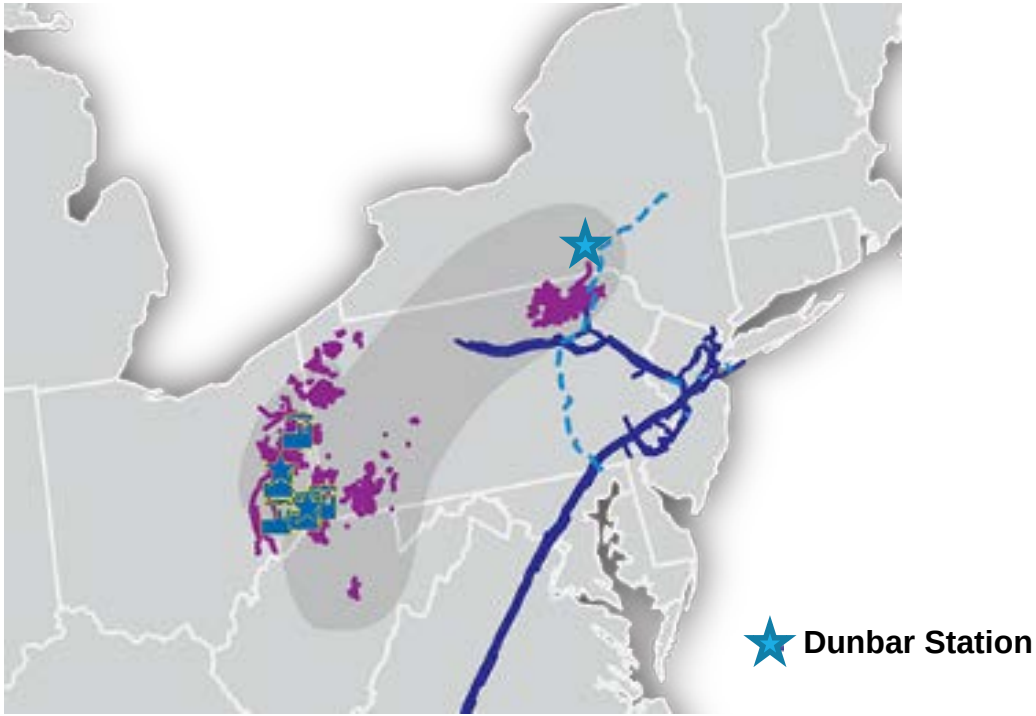
About Williams



- Natural gas gathering, processing, and transportation company founded in 1908
- 5,000 Employees
- Transport 14% of U.S. natural gas consumption
- 11,200 miles of oil and gas gathering lines
- Gas processing capacity of approximately 7 bcf/d
- 1,400 miles of NGL and olefin transportation pipelines

FORTUNE WORLD'S MOST ADMIRED COMPANIES 2015
#1 IN ENERGY: U.S.

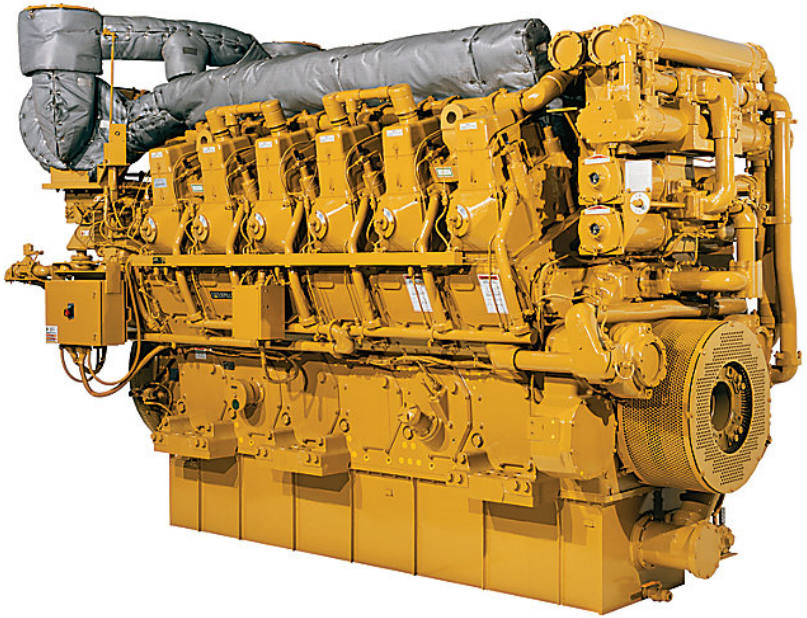
Dunbar Station



- Dunbar Station is located in Windsor, NY
- Four Cat 3600 units
- Flows 275 MMCF/d

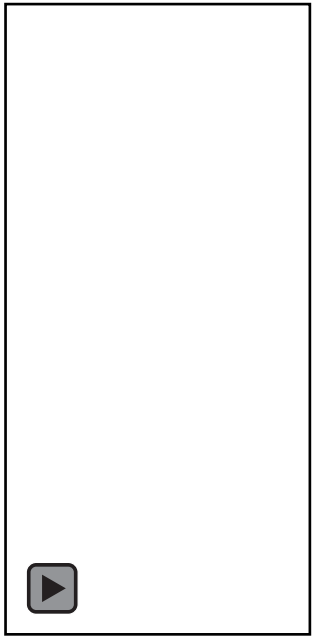
The Challenge

- NOX emissions dependent on proper combustion
- Changes in engine operating conditions can result in an engine falling outside the emissions limits prescribed in its operating permit



The Importance of Burn Time

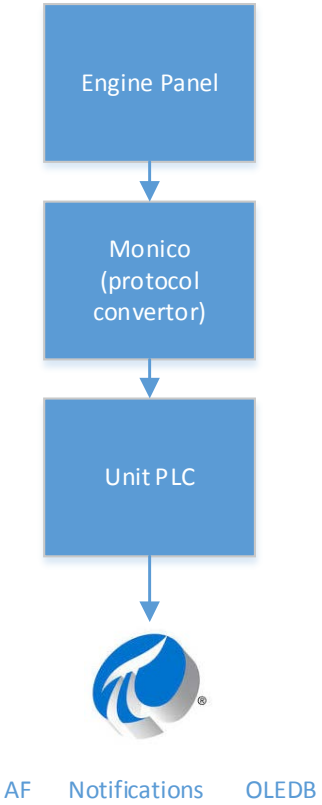
- Burn time is measured by the elapsed time (in milliseconds) after the spark plug ignition occurs until the flame front reaches the sensor inside the combustion chamber
- When combustion is occurring completely, emissions are minimized
- Burn time is the best indicator of the health of the combustion



The Solution

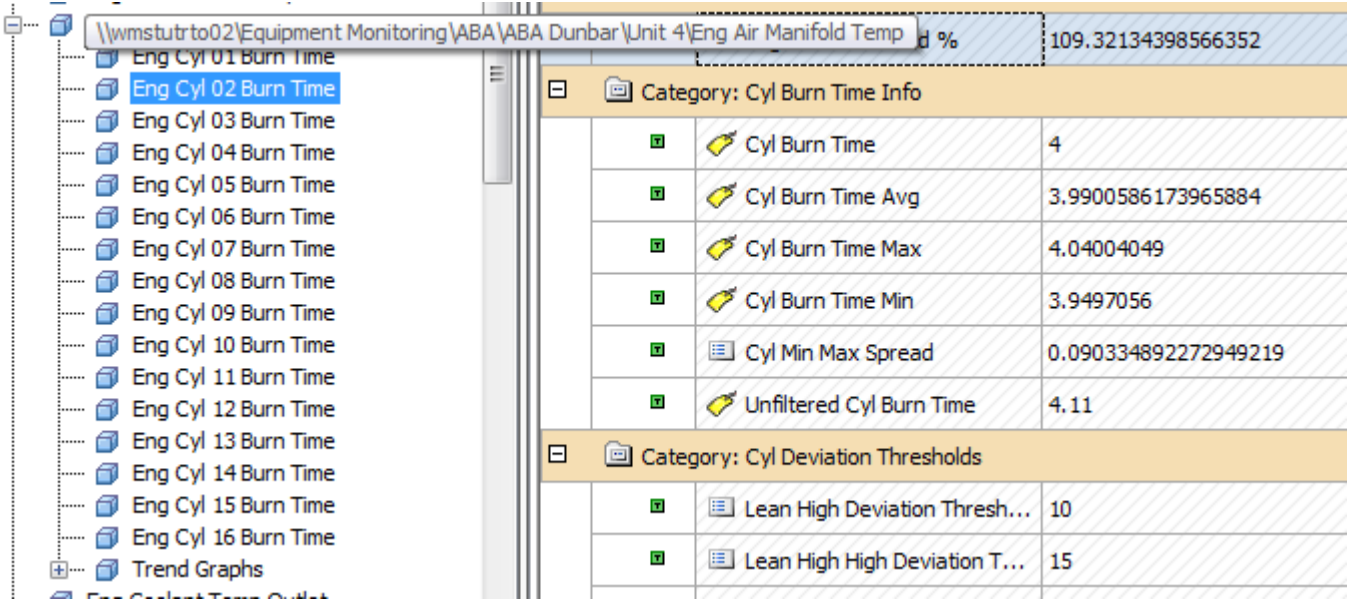
Using the PI System to Help Maintain Emissions Compliance

- PI Asset Framework (AF)
- PI Notifications
- PI OLEDB Enterprise
- PI Coresight
- PI Advanced Computing Engine (PI ACE)



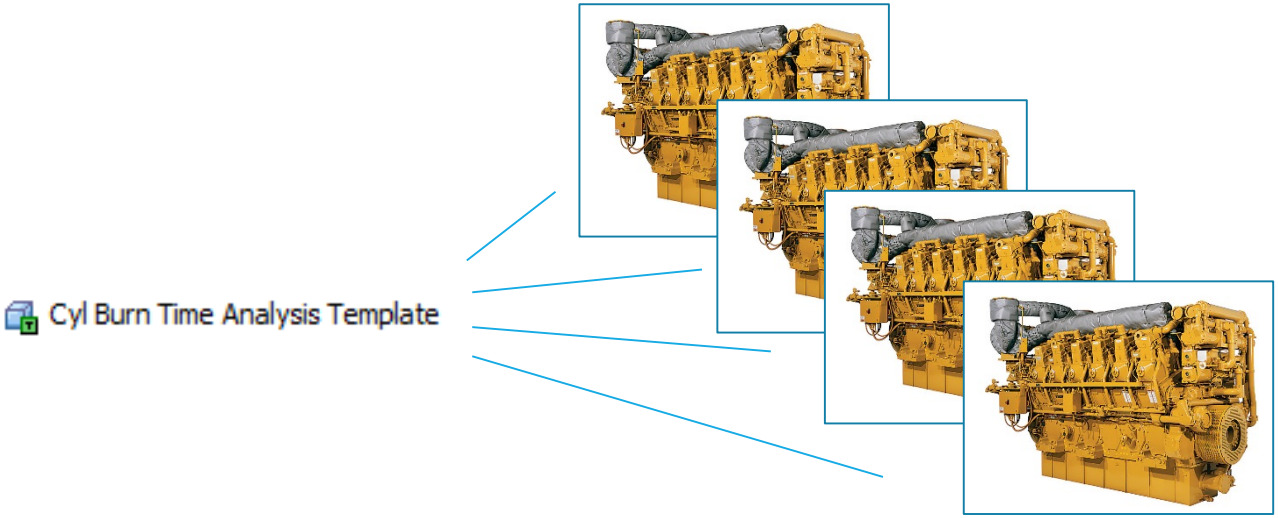
PI Asset Framework

AF enables much more than notifications on a simple threshold for one value



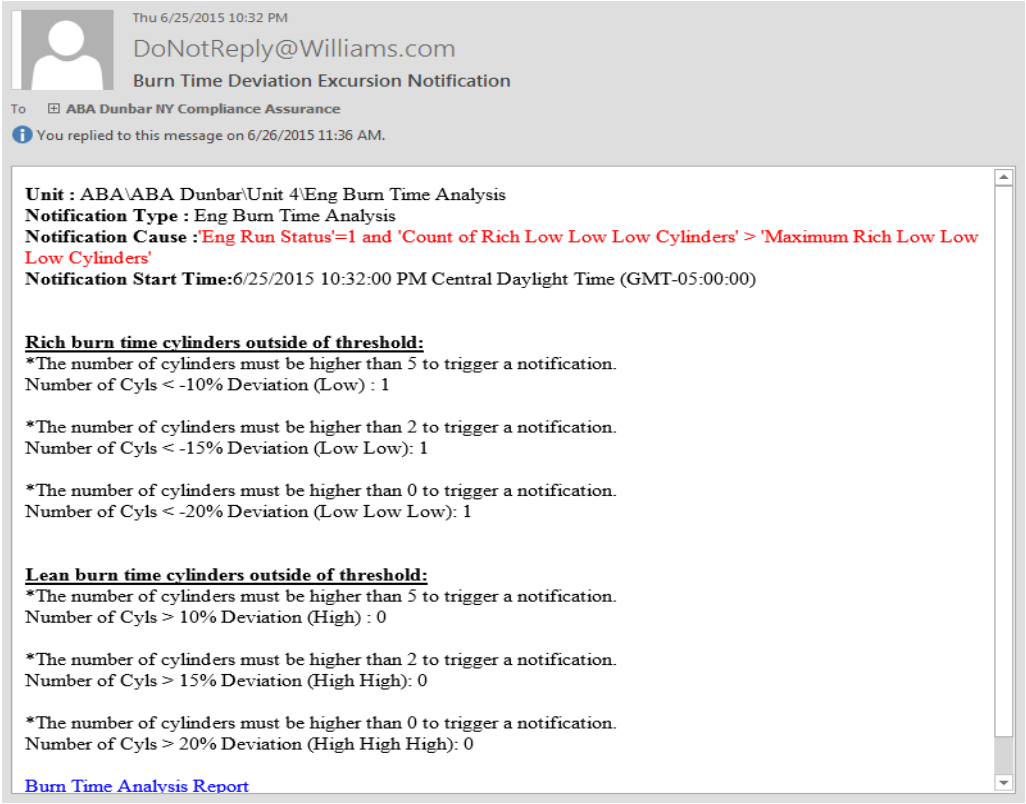
PI Asset Framework

AF Templates are used to create a scalable platform for application to multiple engines



PI Notifications

- Event was brought to the attention of field operational personnel using Notifications
- Notification contains links to a full report



Thu 6/25/2015 10:32 PM

DoNotReply@Williams.com

Burn Time Deviation Excursion Notification

To ABA Dunbar NY Compliance Assurance

You replied to this message on 6/26/2015 11:36 AM.

Unit : ABA\ABA Dunbar\Unit 4\Eng Burn Time Analysis
Notification Type : Eng Burn Time Analysis
Notification Cause :'Eng Run Status'=1 and 'Count of Rich Low Low Low Cylinders' > 'Maximum Rich Low Low Low Cylinders'
Notification Start Time:6/25/2015 10:32:00 PM Central Daylight Time (GMT-05:00:00)

Rich burn time cylinders outside of threshold:
*The number of cylinders must be higher than 5 to trigger a notification.
Number of Cyls < -10% Deviation (Low) : 1

*The number of cylinders must be higher than 2 to trigger a notification.
Number of Cyls < -15% Deviation (Low Low): 1

*The number of cylinders must be higher than 0 to trigger a notification.
Number of Cyls < -20% Deviation (Low Low Low): 1

Lean burn time cylinders outside of threshold:
*The number of cylinders must be higher than 5 to trigger a notification.
Number of Cyls > 10% Deviation (High) : 0

*The number of cylinders must be higher than 2 to trigger a notification.
Number of Cyls > 15% Deviation (High High): 0

*The number of cylinders must be higher than 0 to trigger a notification.
Number of Cyls > 20% Deviation (High High High): 0

Burn Time Analysis Report

PI OLEDB Enterprise

- Report is automatically generated using Microsoft SSRS interfaced to AF using PI OLEDB Enterprise
- This report contains links to Coresight trends

Burn Time Analysis - 15 minute interval averages

Refresh Time: 8/28/2015 4:31:18 PM
Franchise: ABA
Facility: ABA Dunbar
Start Time: 6/25/2015 11:00 PM -1h
End Time: 6/25/2015 11:00 PM

			6/25/2015 10:00:00 PM	6/25/2015 10:15:00 PM	6/25/2015 10:30:00 PM	6/25/2015 10:45:00 PM	6/25/2015 11:00:00 PM
			Total	Total	Total	Total	Total
ABA Dunbar	Unit 4	Filtered Burn Time	4.24	4.24	4.23	4.24	4.24
		Filtered Burn Time Max	4.33	4.33	4.34	4.33	4.33
		Filtered Burn Time Min	4.16	4.14	4.15	4.15	4.15
		Filtered Burn Time Spread	0.17	0.19	0.19	0.18	0.18
		Desired Burn Time	4.30	4.30	4.30	4.30	4.30
		Deviation From Desired	-1.73%	-1.67%	-1.88%	-1.64%	-1.60%
		Cyls < -10% deviation (Rich)	1	1	1	1	1
		Cyls < -15% deviation (Rich)	1	1	1	1	1
		Cyls < -20% deviation (Rich)	1	1	1	0	0
		Cyls > 10% deviation (Lean)					

PI Coresight

June 2015 example of successful identification of a deviation

PI Advanced Computing Engine (PI ACE)

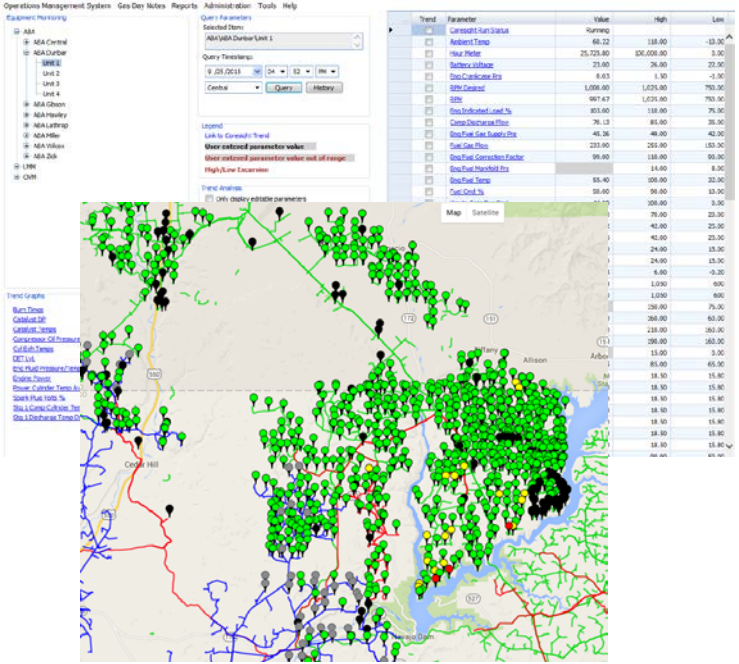
- Used to count misfires within a 15-minute time period
- More efficient than running a query, particularly if an SME is looking at a long period of history

Results and Business Impact

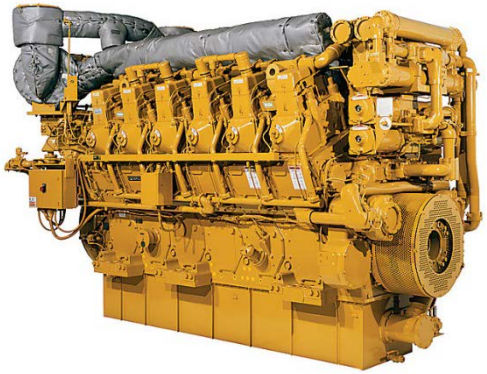
- If a unit falls out of compliance, the cost of shutting that unit down can be $25,000/day
- Since putting this system in place, we have not had any compliance issues requiring us to shut down
- 2015: All engines passed inspection
- NYDEC “very satisfied” with execution of compliance plan

Overall PI System Experience and Future

- Currently running over 15 applications based on PI System Data
- Enterprise is recognizing the value being brought by the system
- Grass-roots efforts with operations have become visible at top levels
- Continuing to expand both applications and asset reach



Engine Burn Time Analysis



COMPANY and GOAL

Williams gathers, processes and transports natural gas, and places a high priority on meeting environmental standards

CHALLENGE

Ensure that NOX permits are not exceeded on its fleet of Caterpillar 3600 engines

- With multiple engines in the fleet and numerous high-profile performance objectives, engine tuning can be forgotten

SOLUTION

PI AF-based solution for monitoring burn times to ensure engine is properly tuned

- PI AF provides continuous 24-hour monitoring using complex calculations
- PI OLEDB Enterprise facilitates reporting by exception, saving valuable time for operations

RESULTS

Successful in improving compliance on NOX emissions from these engines

- Previously, Williams had incurred some violations
- After implementation, all engines passed inspection, and NYDEC was pleased with documentation

Contact Information

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Manager, Asset Performance & Benchmarking

Williams

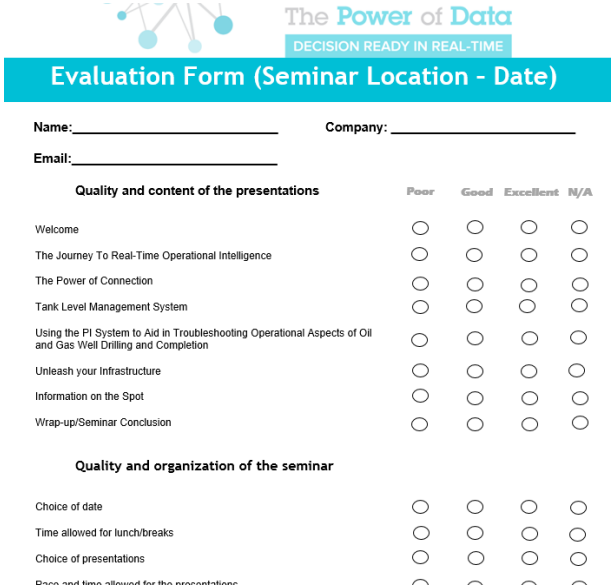
Questions

Please wait for the **microphone** before asking your questions

State your **name & company**

Please don't forget to…

Complete the Survey for this session



The Power of Data

DECISION READY IN REAL-TIME

Evaluation Form (Seminar Location - Date)

Name:_____ Company: _____

Email:_____

Quality and content of the presentations	Poor	Good	Excellent	N/A
Welcome	○	○	○	○
The Journey To Real-Time Operational Intelligence	○	○	○	○
The Power of Connection	○	○	○	○
Tank Level Management System	○	○	○	○
Using the PI System to Aid in Troubleshooting Operational Aspects of Oil and Gas Well Drilling and Completion	○	○	○	○
Unleash your Infrastructure	○	○	○	○
Information on the Spot	○	○	○	○
Wrap-up/Seminar Conclusion	○	○	○	○

Quality and organization of the seminar				
Choice of date	○	○	○	○
Time allowed for lunch/breaks	○	○	○	○
Choice of presentations	○	○	○	○
Pace and time allowed for the presentations	○	○	○	○

감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado