

# Real-time Performance Monitoring and Production Reporting in Midstream Industry

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**PLAINS**  
ALL AMERICAN

# Agenda

- About Plains
- Challenges
  - Real-time performance monitoring
  - Production reporting
- PI System applications & summary
- Transportation proof-of-concept
- Closing

# Who We Are



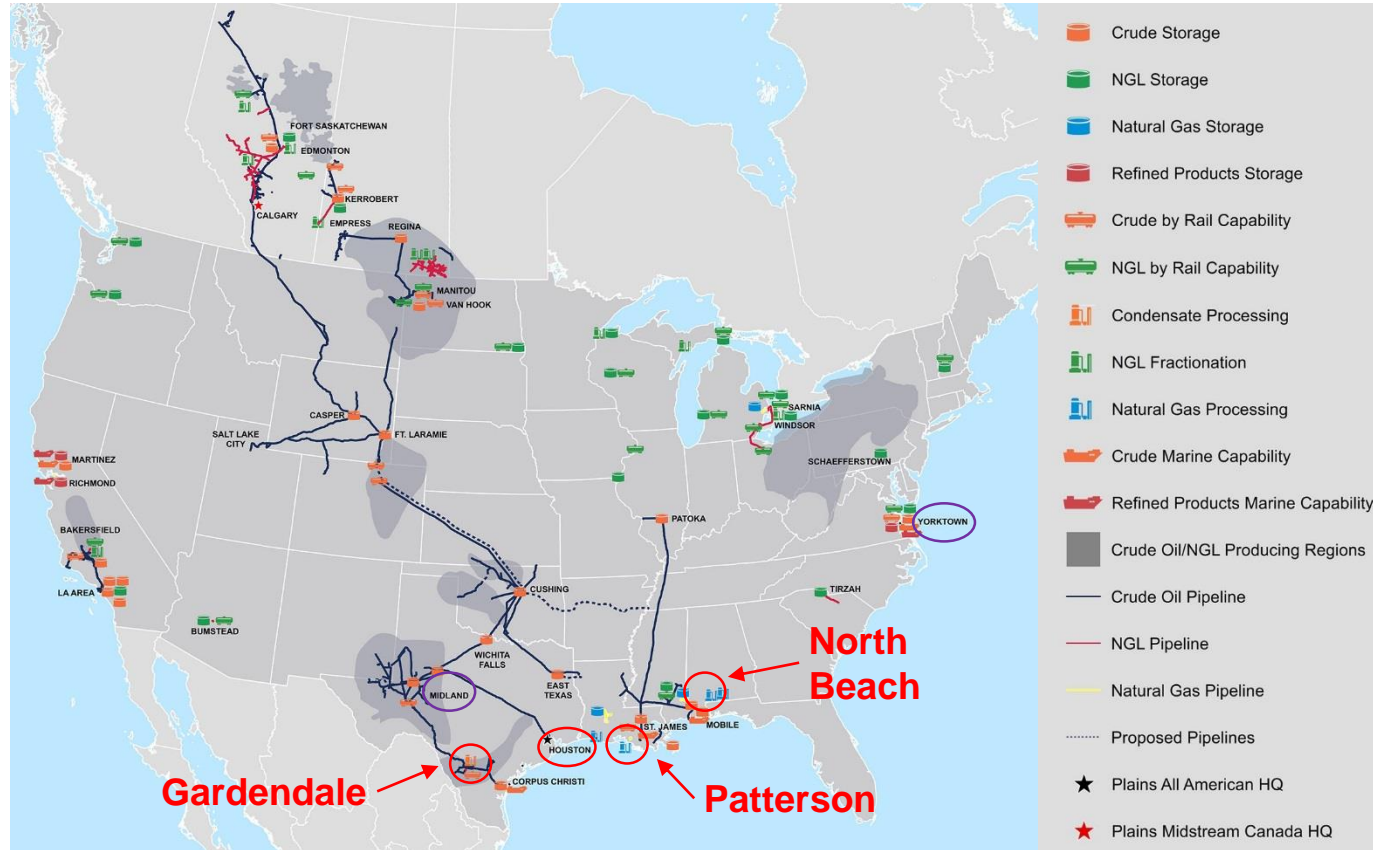
Plains All American (PAA) is a publicly traded master limited partnership that owns and operates midstream energy infrastructure and provides logistics services for crude oil, natural gas liquids, natural gas and refined products.

PAA owns an extensive network of pipeline transportation, terminalling, storage and gathering assets in key crude oil and NGL producing basins and transportation corridors and at major market hubs in the United States and Canada.

Plains Gas Solutions (PGS) is a Houston-based midstream resource management company that designs and operates gas processing and condensate processing plants to help producers optimize revenues and minimize costs



# Plains Asset Base



# Challenges

- Performance monitoring and visualization
  - Only local access to data
  - Limited trending capability on HMI computers
  - No visibility for upper management
- Production reporting
  - All reports being manually built out of spreadsheets
  - Strict accounting format
  - Cumbersome manual entry

# Building the AF Database

- OSIssoft Jumpstart - Summer 2014
  - Initiated PI Asset Framework build-out
    - On-site training
    - PI Coresight installation
    - Security/permissions set-up
- PI AF: the foundation for all calculations and analyses
  - Developed a basic set of Key Performance Indicators (KPIs)
  - Applied templates to all existing PGS assets with local PI servers
  - Consistency is key!

# PGS Asset Framework Configuration

Templates were used within each element for consistent data mining and calculations

Flows were converted to mass for accurate real-time balancing

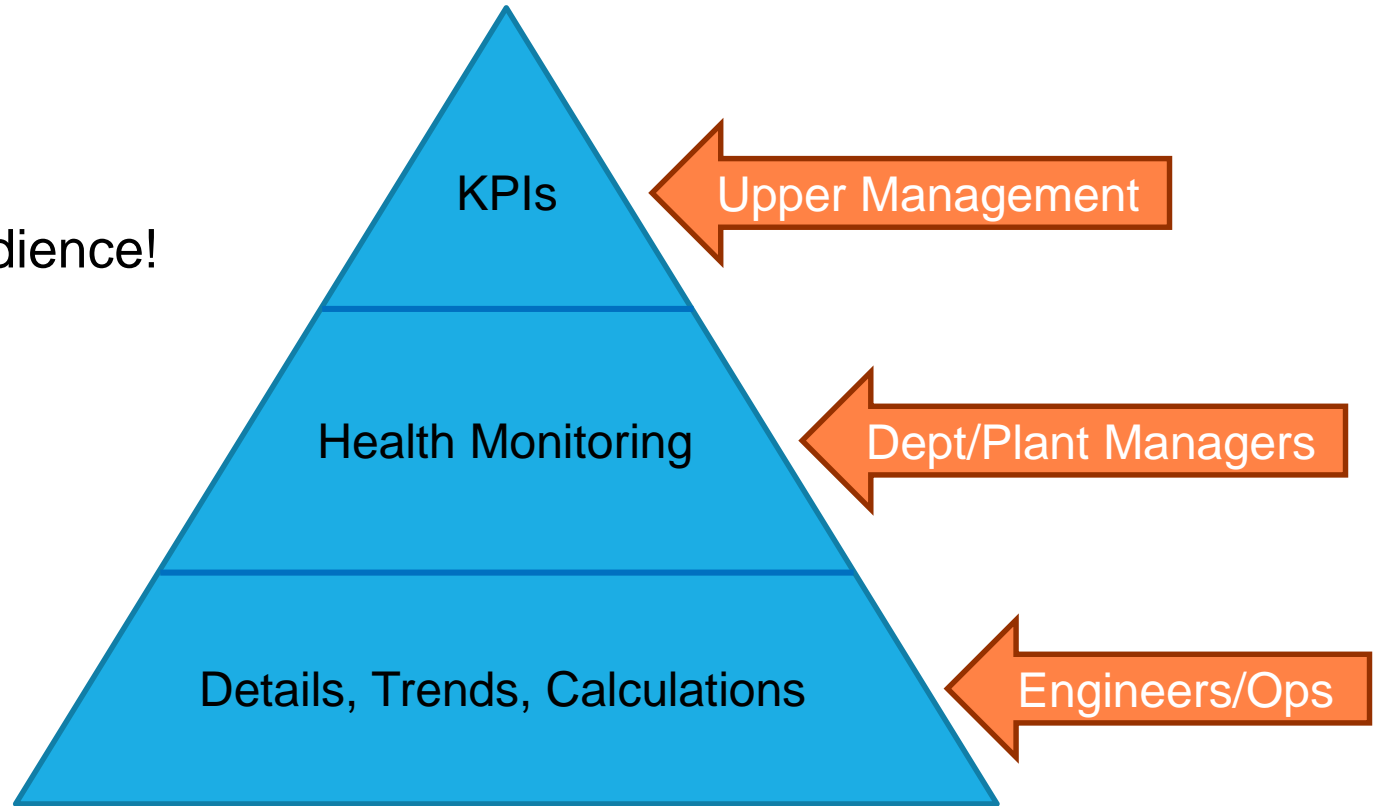
PI AF Analytics were utilized to perform calculations and write results to PI tags

The screenshot displays the PI System Explorer interface. On the left, the 'Elements' tree shows a hierarchy where 'Material Balance' is expanded, and 'Gardendale Balance (Analysis)' is selected. A red circle highlights this element in the tree. Another red circle highlights a list of heat exchangers (HT16.01 through HT16.12) under the 'Process' folder. The main pane shows the 'Material Balance' configuration for 'Gardendale Balance (Analysis)'. A red circle highlights the 'Name' field, which is set to 'Gardendale Balance'. Below this, a table lists the flows used in the balance calculation, with a red circle highlighting the 'Gardendale Balance' row. The table has columns for 'Name' and 'Backfilling'. The 'Name' column contains the following expressions:

Name	Expression
X	'Feed to Train 1 - mass'+'Feed to Train 2 - mass'+'Feed to Train 3 - mass'+'Fuel Gas Supply - mass'
Y	'Flow to Process Flare - mass'+'NGL Product Train 1 - mass'+'NGL Product Train 2 - mass'+'NGL Product Train 3 - mass'+'Stabilized Condensate Pr
Z	(X-Y)/X*100

# Visualization Considerations

Know Your Audience!





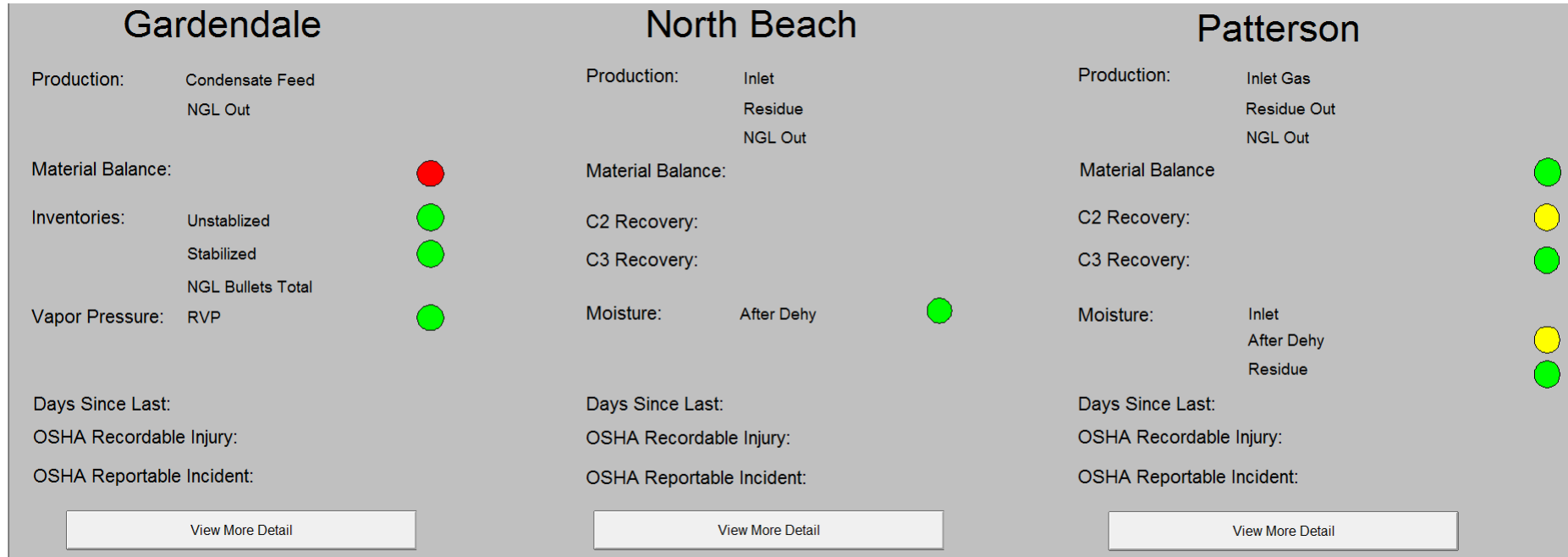
# Key Process Indicators (Upper Management)

- ✓ Utilize PI WebParts for visualization on the company SharePoint page



# Health Monitoring (Dept/Plant Managers)

- ✓ Utilize PI ProcessBook for visualization during weekly department meetings
  - Red/yellow/green “stoplights” allow quick determination of plant health



***Gardendale***

# Real-time Performance Monitoring Summary

- Take time to properly build-out the AF Database
  - Sets the foundation for data mining and proper calculations
- Determine audience
  - Upper management vs. engineering
- Do not exclude Operations
  - Pre-built trends assist operators with running and optimizing units
    - Allows operators to view the same data as engineers

# Production Reporting Challenges

- Reporting basis was dissimilar for different departments
  - Accounting prefers liquid in barrels/gallons and gas in MMBtu
    - Based on interconnect contracts with producers/customers
  - Engineering prefers everything in mass
    - A pound is a pound is a pound...
- Different facilities have different unit operations
  - PGS Gardendale → condensate stabilization
    - Simple distillation, heat optimization
  - PGS Patterson → gas processing
    - Moisture adsorption, turboexpander, cryogenics, heat optimization



# Production Reporting Variations

GARDENDALE DAILY PRODUCTION REPORT (Bbls)														
Beginning Condensate Inventory					From PSTG		From Truck		From Tanks		From Tanks to Plant		Water fr Tanks	
Day	A	B	C	D	Total	to Tanks	to Tanks	to PSTG	to Plant	to Trucks	Balance	A	B	C
1														
2														
3														
4														
5														
6														
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Avg	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!				
Total						0	0	0						

All custody transfer values in *barrels*

PATTERSON PLANT DAILY TARGET / PRODUCTION REPORT May														
TRUNKLINE					PRODUCTION					HILCORP				
Day	MMCFD	MMBTU	Residue	MMCFD	MMBTU	Residue	MMCFD	MMBTU	Residue	MMCFD	MMBTU	Residue	MMCFD	MMBTU
1														
2														
3														
4														
5														
6														
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Avg	#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!

All custody transfer values in *MMBtu*

NORTH BEACH I and II DAILY OPERATING REPORT									
Date: 1/17/2016					Time: 7:00A.M.				
1. INLET METER			NB I		NB II		2. Outlet Meter		
a) Psig							a) Psig		
b) MCF/D							b) Reinject MCF/D		
c) BTU/CF							c) BTU/CF		
e) GPM							e) GPM		
f) H2S PPMV							f) H2S PPMV		
f) N2 Mole%							f) N2 Mole%		
g) Total Inlet							g) Total Inlet		
h) JDP across Inlet							h) JDP across Inlet		
</									

# Real-time vs. Daily Reporting

- Utilize the AF Database element structure



- Run analyses at prescribed times each day
  - Snapshots
    - D Inventory, custody transfer meters
  - Averages
    - Process variables, compositions
  - Capture values already calculated in HMI/DCS

# How to Manage Manual Values

- Not all desired data is in HMI, DCS, or the PI System
- Use “Write to PI” functionality via Excel VBA and PI Datalink

Input values				Read back from PI	Description	Acceptable ranges	
Timestamp	Tagname	Value	Results	Value		Minimum	Maximum
9/21/16 9:56	GDN_NGLTrucks	0			NGL to trucks	0	5000 bbls
	GDN_TankH2O	0			Water from tanks	0	1500 bbls
	GDN_CuStrip	1B			Copper strip test	n/a	n/a
	GDN_V111_H2S	0			Train 1 H2S	0	50 ppm
	GDN_V121_H2S	0			Train 2 H2S	0	50 ppm
	GDN_V131_H2S	0			Train 3 H2S	0	50 ppm
	GDN_Inlet_RVP_avg	11.59			Avg. Inlet Grabner	9	20 psi
	GDN_Outlet_RVP_avg	8.71			Avg. Outlet Grabner	5	12 psi
Send above values to PI		PI Server Name: PAAHOUP1					
**Enter values only in the GREEN box**							

- Capture commodity prices to perform financial analysis

Input values				Read back from PI	Description	Acceptable price ranges	
Timestamp	Tagname	Value	Results	Value		Minimum	Maximum
9/21/16 9:58	INDEX_HenryHub	2.345			Henry Hub Nat. Gas	1	20 \$ / MMBtu
	INDEX_MtBel_C2	15.25			Mt. Belvieu Ethane	5	150 ¢ / gal
	INDEX_MtBel_C3	36.375			Mt. Belvieu Propane	5	150 ¢ / gal
	INDEX_MtBel_nC4	54.25			Mt. Belvieu n-Butane	30	200 ¢ / gal
	INDEX_MtBel_iC4	54.25			Mt. Belvieu iso-Butane	30	200 ¢ / gal
	INDEX_MtBel_C5	83.5			Mt. Belvieu Pentane	50	300 ¢ / gal
	INDEX_WTI	33.97			West Texas Intermediate	10	150 \$ / bbl
Send above values to PI		PI Server Name: PAAHOUP1					



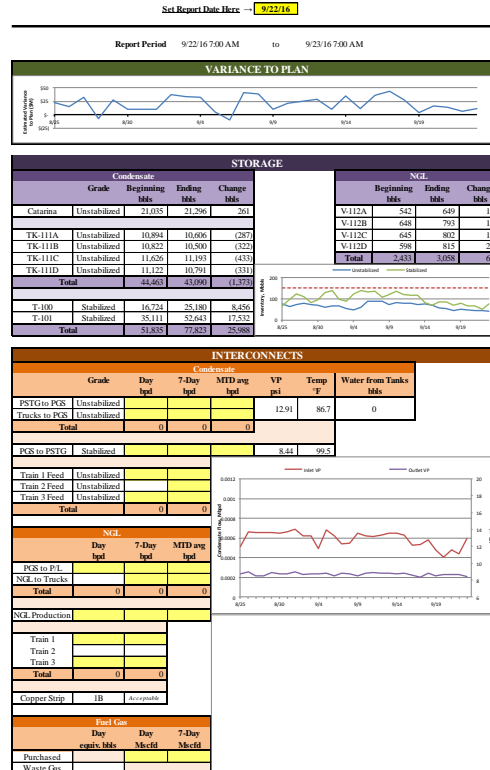
# Final Production Reporting

- New Excel file pulls all data from the PI System via PI Datalink
  - PI tags, AF attributes, and manual “Write to PI” values
- Four-step process
  - 1) Change Excel report date
  - 2) Validate data
  - 3) Save Excel file to PDF
  - 4) Attach to email and distribute
- Reduced reporting time from 30-45 min to 5 min or less
- New reports include trends, KPIs, and limits/constraints



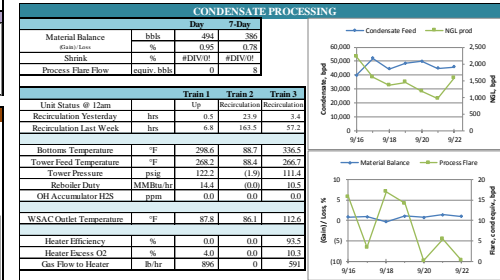
# Final Production Reporting

GARDENDALE DAILY PRODUCTION REPORT (Bbls)																	
Day	Beginning Condensate Inventory Tank					From PSTG to Tanks	From Truck To Tanks	From Tanks to PSTG	From Tanks to Plant	Water fr Tanks to Trucks	Calc Tank Balance	Measured Ending Condensate Inventory Tank					Tank G/(L)
	A	B	C	D	Total							A	B	C	D	Total	
1																	
2																	
3																	
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Total						0	0	0	0	0							



Refresh Data

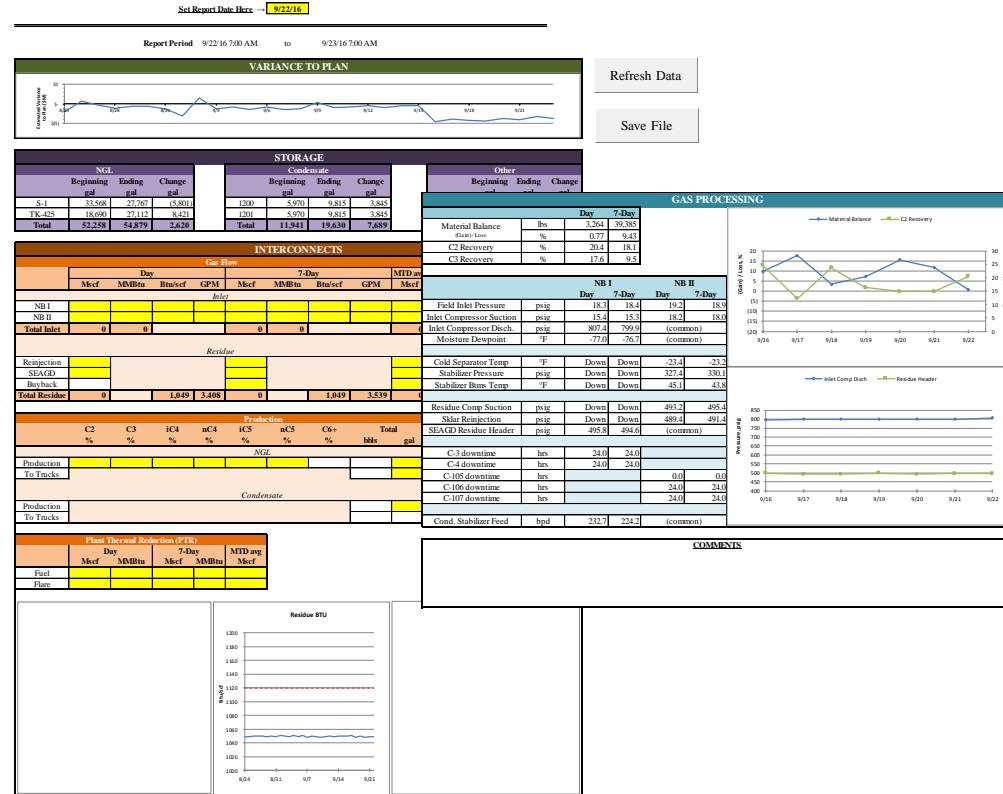
Save File



COMMENTS

# Final Production Reporting

NORTH BEACH I and II DAILY OPERATING REPORT			
Date: 1/17/2016		Time: 7:00A.M.	
<b>1. INLET METER</b>		<b>2. Outlet Meter</b>	
NB I	NB II		
a) Psig		a) Psig	
b) MCF/D		b) Reinject MCF/D	
c) BTU/CF		c) SEAGD MCF/D	
e) GPM		d) Total MCF/D	0
f) H2S PPMV		e) BTU/CF	
f) N2 Mole%		f) GPM	
g) Total Inlet	0	g) H2S PPMV	24 HR AVE.
h) DP across Inlet Filters		h) Visible Emissions	(flare)(Y/N)
		i) Flare Pilot Lit	
<b>3. Product Specs (Y/N)</b>		<b>6. PTR</b>	
a) Inlet Gas >950 MCF/D		a) Measured By-Back Fuel M	
b) Outlet Gas < 1050 BTU/CF		b) Measured By-Back Fuel B	
c) Product Tank < 235#		c) Measured Flare MCF/D	
		d) Measured Flare BTU/CF	
		e) Fuel MCF/D NB I INLET	
		f) Fuel MCF/D NB I REF	
		g) Fuel MCF/D NB II INLET	
		YTD Flare MCF ADD PREV. DAYS EMISSIONS	
<b>4. Pressures (psig)</b>		<b>5. Temp (Degrees F)</b>	
NB I	NB II	NB I	NB II
a) Inlet Compressor Ps		a) Cold Separator	
b) Inlet Compressor Pd		b) Overhead Comp. Suction Temp.	
c) Stabilizer Tower Psig		c) Stabilizer Tower Bottom	
d) Overhead Compressor Ps		d) MA 102	
e) Overhead Compressor Pd			
f) Refrig Compressor Ps			
g) Refrig Compressor Pd			
h) Residue Ps			
i) Residue Pd			
<b>9. Daily Hours of Run Time</b>		<b>9. Daily Hours of Run Time</b>	
NB I	NB II	NB I	NB II (2)
a) Inlet Compressor		a) Residue Compressor	/
b) Refrigerant Compressor		e) Overhead Compressor	
c) Measured Flare		f) VRU	



# Keep the Accountants Happy...

[illegible]

# Production Reporting Summary

- Utilize PI Analytics and PI AF to perform calculations and store values
  - Adjust timing based on business needs
- Automate as much as possible
  - Be creative!
- Enable consistent report structure
  - Make it easy to extract comparable data from multiple reports

# PAA Transportation – Introduction



- PAA Transportation: fee-based activities associated with transporting crude oil and NGL
  - Comprises pipelines, gathering systems, trucks and barges
  - Includes 18,000+ miles of active liquid hydrocarbon pipelines
  - Includes approximately 30 million barrels of active, above-ground tank capacity
- PAA Facilities: fee-based activities associated with providing storage, terminalling and throughput services for crude oil, refined products, NGL and natural gas, as well as NGL fractionation and isomerization services, and natural gas and condensate processing services
  - Includes approximately 100 million barrels of liquid storage
  - Includes 97 Bcf of natural gas storage working capacity



# PAA Transportation – Current State

- For years the PI System was used as data historian only
  - Used primarily on an as-needed basis for lookback and engineering analysis
  - Generally limited in use to Engineering and SCADA groups
- Significant value is not being realized
  - Repetitive tasks are being done by people rather than automation
  - Value-adding tasks are not being done at all due to their repetitive nature and/or insufficient resources
- Primary tools are PI DataLink and PI ProcessBook

# PAA Transportation – Goals

- PI System data is useful to essentially all business functions:
  - Operations/Engineering
    - Maintenance planning, CBM and monitoring equipment health, optimization, reporting
  - Management
    - High level reporting (metrics, dashboards)
  - Accounting
    - Financial accruals, volume data
  - As well as many more value adding tasks that either reduce effort or enable new capabilities

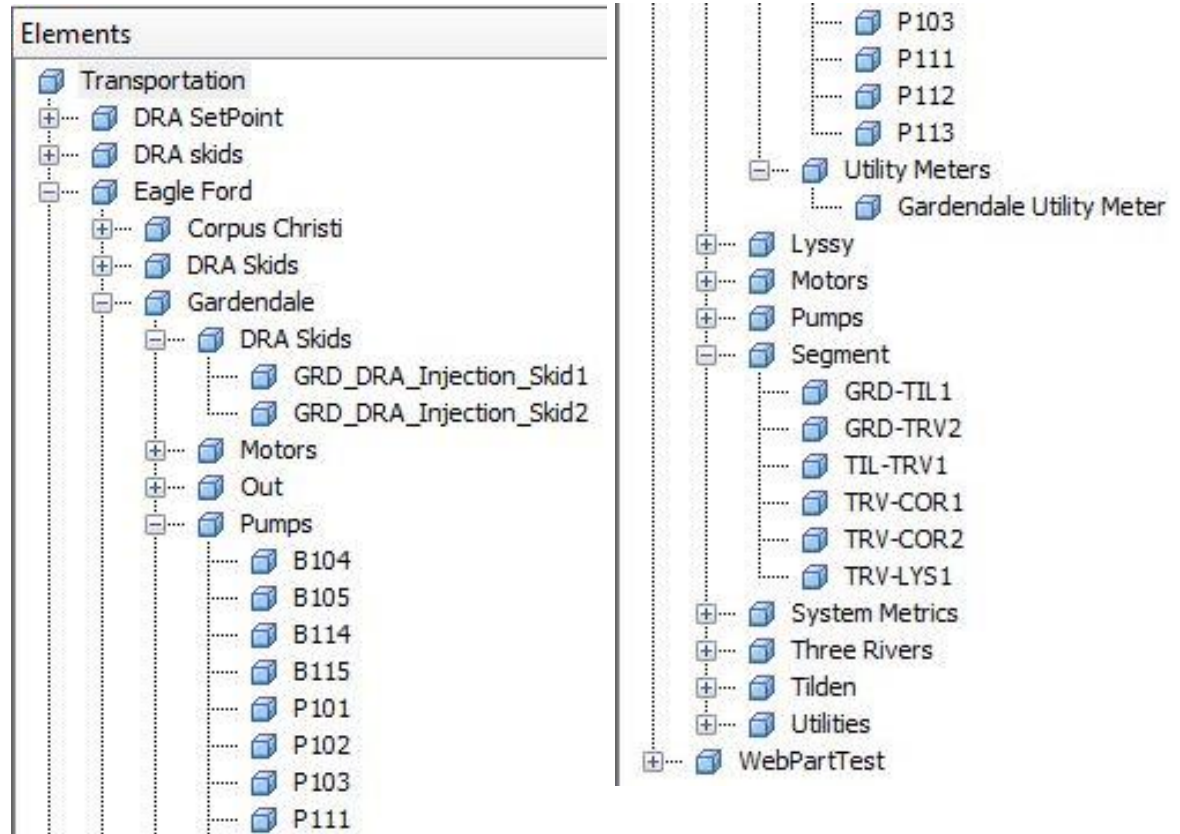


# PAA Transportation – Proof of Concept

- Demonstrate PI AF functionality on one pipeline system
  - Leverage CSE Icon as PI System consultants
  - Build AF structure, analyses, and reports
  - Utilize templates, naming conventions, etc. as much as possible to enable easy future expansion
- AF structure is currently complete
- Analyses and reports are to be finished by EOY

# PAA Transportation Proof of Concept

## AF Hierarchy



# PAA Transportation Proof of Concept

## Pump element template

[-]	Category: Equipment Metrics	
	Efficiency % Of Curve	0 %
	Flow % Of BEP	0 %
	Head % Of Curve	0 %
+	Category: Equipment Specs	
[-]	Category: Operating Data (Calculated)	
	Adjusted Flow	0 US gal/min
	Adjusted Head	0 ft
	Estimated Efficiency	0
	Estimated Motor Horse...	0 hp
	Expected Efficiency	0
	Hydraulic Horsepower	0
	Motor Horsepower	0 hp
	Predicted Head @ 100...	1247.9 ft
	Pressure Rise	0 psig
	Specific Gravity	0.79799233162377581
[-]	Category: Operating Data (Measured)	
	Discharge Pressure	0 psig
	Flowrate (bph)	0 bbl/h
	Gravity	45.819999694824219
	Speed	0 %
	Status	OFF
	Suction Pressure	0 psig

# PAA Transportation Proof of Concept

## DRA

(Drag Reducing Agent)

element template

Category: Equipment Specs		
Category: Metrics (Inputs)		
	Price per Unit	
Category: Metrics (Outputs)		
	Daily DRA Cost	
	Daily DRA Volume	US gal
	Monthly DRA Cost	0
	Monthly DRA Volume	0 US gal
Category: Operating Data (Calculated)		
	Ideal Injection Rate	5
Category: Operating Data (Measured)		
	Accumulator	US gal
	Flow Rate	US gal/h
	Flow Rate Setpoint	bbl/h
	Gravity	45.819999694824219
	PPM Actual	ppm
	PPM Setpoint	ppm
	Tank Level	1456 US gal

# PAA Transportation Proof of Concept

## Utility element template

Category: <None>			
		Maximum kW Allowed	999999 kW
		Price per Unit	0.06
Category: Equipment Specs			
		Account number	0
		Baseline kW	kW
		Description	
		kW Used	Estimated kW
		Utility Area Prefix	GRDEF
		Utility company	0
		Utility Meter Number	01
Category: Operating Data (Calculated)			
		Estimated station kW	kW
		Station kW (15 Min Avg)	
Category: Operating Data (Measured)			
		Measured station kW	0 kW
		Measured station pf	0

# PAA Transportation – Proof of Concept

- Reports
  - Pump performance/health
  - Motor performance/health
  - Monthly barrel-mile (amount and distance shipped)
  - DRA skid performance (is it doing what it is being told to do)
  - Operational efficiency - power and DRA (drag reducing agent)
  - Monthly energy metrics

# PAA Transportation – Next Steps

- Begin using for Energy Management
  - There is increased business focus on operational excellence
  - The equivalent of 3 full-time employees are responsible for optimizing 20,000 miles of pipeline and multiple facilities
    - Identify tasks and reporting that add the most value
    - Begin deployment on the newest and largest systems first

# PAA Transportation – Next Steps

- Expected uses
    - Monitor/metric operations vs. operating guidelines
    - Track monthly metrics for reporting to upper management
    - Monitor performance/health of pumps and drag reducer chemical
    - Develop/refine tools for keeping hydraulic models tuned to real-world conditions
    - Forecast monthly power costs for accounting accruals
    - Track and prove savings from projects implemented
- Other uses TBD....



# Concluding Comments

- PI AF is seen as strategic
  - Powerful tool for asset management and advanced calculations
- We anticipate the PI AF momentum to continue
  - Expand use of performance monitoring
  - Extend analysis and monitoring to Transportation assets

# Contact Information

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Manager, Energy Management

Plains All American



# 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	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Journey To Real-Time Operational Intelligence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Power of Connection	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tank Level Management System	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using the PI System to Aid in Troubleshooting Operational Aspects of Oil and Gas Well Drilling and Completion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unleash your Infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information on the Spot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wrap-up/Seminar Conclusion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Quality and organization of the seminar

Choice of date	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time allowed for lunch/breaks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Choice of presentations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Break and time allowed for the presentation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



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감사합니다

谢谢

Danke

Merci

Gracias

**Thank You**

ありがとう

Спасибо

Obrigado

