



KPI's & Wireless Manual Data

Presented by **Bryan Pigg**

KPI's & Wireless Manual Data

How can the PI System be leveraged to not only collect data but use that data to improve the efficiency of plants on a real time basis.



Business Challenge

- Need to find process problems quickly
- Not collecting all data, electronically, that the plants generate

Solution

- Implement KPI's for plants and plant systems
- Utilize wireless readings and form based data entry to achieve 100% data collection.

Results and Benefits

- By identifying problems in the process quickly, efficiency can be held at a higher level, minimizing production loss

Introduction

- Introduction of the PI System to CF – Yazoo City
 - PI System was installed in 1995
 - Was configured to collect data from a Fisher Provox/Provue DCS system via a CHIP interface.
 - PI ProcessBook and PI DataLink was the only software utilized.
 - PI System Today
 - Collects data from DeltaV via PI Interface for OPC HDA
 - Collects data from SQL via PI Interface for RDMS
 - Provides data to SharePoint via PI WebParts & PI DataLink Server
 - Provides alerts via PI AF and PI Notifications
 - Provides data to StackVision (NOx Data Collector) via PI Interface for Modbus Ethernet
- Personal Experience
 - Inspection Data
 - All inspection data was written on paper, twice
 - If trending was desired a redundant data entry was entered into an Excel spreadsheet
 - Analytical Data
 - All analytical data was written on paper
 - Data was shared via phone calls

How is this data of any use if it only exists on paper?

Value of PI System @ CF – Yazoo City

- Daily Production & Inventory Reporting
- Control Raw Material Usage
- Form Based Data Collection
- KPI's for Plant Health
- Wireless Manual Data

Daily Production & Inventory Reporting

- Viewed via SharePoint
- Excel spreadsheet with data provide by PI DataLink Server
- Inventories hyperlinked to PI Trend web parts
- Date is a parameter to allow viewing reports in the past

DAILY OPERATING SUMMARY				Date: 10/21/13	
#3 NH3 production		PRODUCTION	1596.564	RUNTIME	24.00
Acid #10	95.93 %		622.080		24.00
#9	91.82 %		396.479		16.00
#8	94.03 %		1023.883		24.00
#6	94.38 %		331.885		24.00
TOTAL			2374.326		
AN Synthesis			2427.010	SYN	24.00
ANF Bulk Production			705.917	FIN #2	0.00
INVENTORY ADJ			0.000	#3	21.50
LDAN			612.000	#4	24.00
Urea 100%			275.263	#1 Urea	5.00
UAN			485.979	#2 Urea	24.00
CO2			0.000	N2O4	0.00
N2O4 Production (pounds)			0.000	Cogen	24.00
Cogen Production					
Electrical, kWh			420200.000		
Electrical Sales to MP&L			3400.000		
Electrical Purchase from MP&L			3470.000		
STORAGE N2O4 (pounds)		39251.016	DESC Owned N2O4	0.000	
Acid		1032.162	Urea	701.380	
93% AN		997.579	CO2	0.000	
UAN Make		847.483	Hilltop	7289.786	
UAN Car Stg		0.000	UAN Inv.	27441.260	
UL Tank		691.458			
ANF (Bin)		474.834	LDAN (Dome)	278.746	
Port Tank 1		1780.507	Tank 2	1381.800	
Tank 3		7060.200	Tank 4	9384.528	
AMMONIA					
NH3 Car Storage		0.000			
Spheres #1		516.106	#2	480.138	
#3		0.000	#4	0.000	
Atm. Stg.		13266.961	TOTAL	14263.205	
Raw Material Receipts and Product Loaded for Shipment					
Acid Purchases			0 Trk	0.000 Tons	
Ammonia Purchases		0 Car	0 Trk	0.000 Tons	
Acid Shpts		0 Car	2 Trk	29.878 Tons	
Ammonia Shpts		0 Car	0 Trk	0.000 Tons	
CO2 Shpts		0 Car	0 Trk	0.000 Tons	
Urea Solution Shpts		0 Car	9 Trk	68.451 Tons	
AN Solution Shpts		7 Car	8 Trk	732.465 Tons	
ANF Bulk Shpts		5 Car	4 Trk	595.825 Tons	
LDAN		6 Car	0 Trk	630.800 Tons	
UAN Shpts Plant		0 Car	0 Trk	0.000 Tons	
UAN Shpts Port		11 Car	0 Trk	1081.25 Tons	
UAN Pipeline				951.15 Total to Port	
Plant to Customer			0.000 Tons		
Port to Customer			0.000 Tons	0.000 Total to Cust.	
				1,081,250 Total UAN	
MONTHLY AVERAGE PRODUCTION TO DATE					
Ammonia		1554.570	UAN	658.352	
Acid		2146.390	N2O4	0.000	
Urea		359.717	AN SYN	2609.271	
ANF		734.221	LDAN	597.363	
CO2		0.000			

Control Raw Material Usage

TEXAS-EASTERN Use Adjustment Calculation

	10/22/2013 9:00	9:00	BTU Value of Gas	1.001
	10/22/2013 13:17	10/22/2013 13:17		
		4:17		
AMMO03AA134FI0603APV	4.807175166	1.12	26.93514	Projected total day use,MMSCFD
			26.96208	Projected total day use,MMBTU
Texas-Eastern Correction	1.00000			
			Hrs	Min
			Hours into Contract Day	
			4	17
				4.28
			Hrs	Minutes
				Decimal Hours
Desired total day use maximum	26.97			MMSCFD
Desired total day use maximum	27.000			MMBTU/Day
Current use to day	4.811982341			MMBTU
Amount left to use	22.18801766			MMBTU
Hours remaining in day	19.71666667			Decimal Hours
Projected use rate in MMBTU	1.125343246			per Hour
Projected use rate in MMBTU/Day	27.00823789			MMBTU/Day
Desired use rate in SCFD rate	26.98125664			<i>Run Here to achieve today's goal</i>
Difference in actual versus projected	-5061.06953			SCFH
				Plus means pulling more than projected
Approximate Process Gas to Adjust to FIC-1	(2869)			SCFH
			Add	(1.0) Clicks of Rate

	4	17	4.28
Hrs		Minutes	Decimal Hours

Start Time	-4m
End Time	*

<i>This is the average for the last -4m</i>	
TE Average Rate FI-0603/	
26.85979097	MMSCFD

Form Based Data Collection

- InfoPath form published to SharePoint
- Utilizing custom web services and PI SDK to send data to PI Server

The screenshot shows a web browser window displaying a data entry form titled "Operations Cooling Tower Data Entry" from CF Industries. The form is organized into a grid of input fields for three cooling towers: #7, #8, and #9. Tower #7 is highlighted in pink, #8 in blue, and #9 in blue. Each tower's section includes fields for pH, SiO2, Ortho PO4 (ppm), Conductivity, Chlorine (ppm), Chlorine Flow (ppd), and flow rates for BC-40, CW-1067, and CW-2037 (ml/min). A "Comments:" field is provided for each tower. To the right of the towers are fields for "Make Up" (SiO2) and "aMDEA" (Foam Height, Collapse Time, Anti Foam, New Makeup). At the bottom, there are "Comments:" fields for towers #3, #9, and #10, and a "Submit" button. A note at the bottom states: "Notes: If there is no data for a given cooling tower, leave the fields blank."

Form Based Data Collection (cont.)

- Data Validation
- Hyperlinking

CF Industries

Operations Cooling Tower Data Entry

Date: 10/22/2013 AM PM

#7 Cooling Tower	#8 Cooling Tower	#10 Cooling Tower
pH: 8.8	pH: 9.1	pH: 8.8
SIO2: 104	SIO2: 142	SIO2: 162
Ortho PO4: 13 ppm	Ortho PO4: 33 ppm	Ortho PO4: 17 ppm
Conductivity: 246	Conductivity: 334	Conductivity: 1210
Chlorine: 19 ppm	Chlorine: 22 ppm	Chlorine: 33 ppm
Chlorine Flow: 50 ppd	Chlorine Flow: 80 ppd	Chlorine Flow: 40 ppd
BC-40: 11 ml/min	BC-40: 17 ml/min	BC-40: 9 ml/min
CW-1067: 5 ml/min	CW-1067: 19 ml/min	CW-1067: 10 ml/min
CW-2037: 11 ml/min	CW-2037: 9 ml/min	CW-2037: 6 ml/min
Comments: lowered d2 from 275 to 150	Comments: cut d2 from 50 to 30 ppd	Comments: cut d2 back to 40ppd

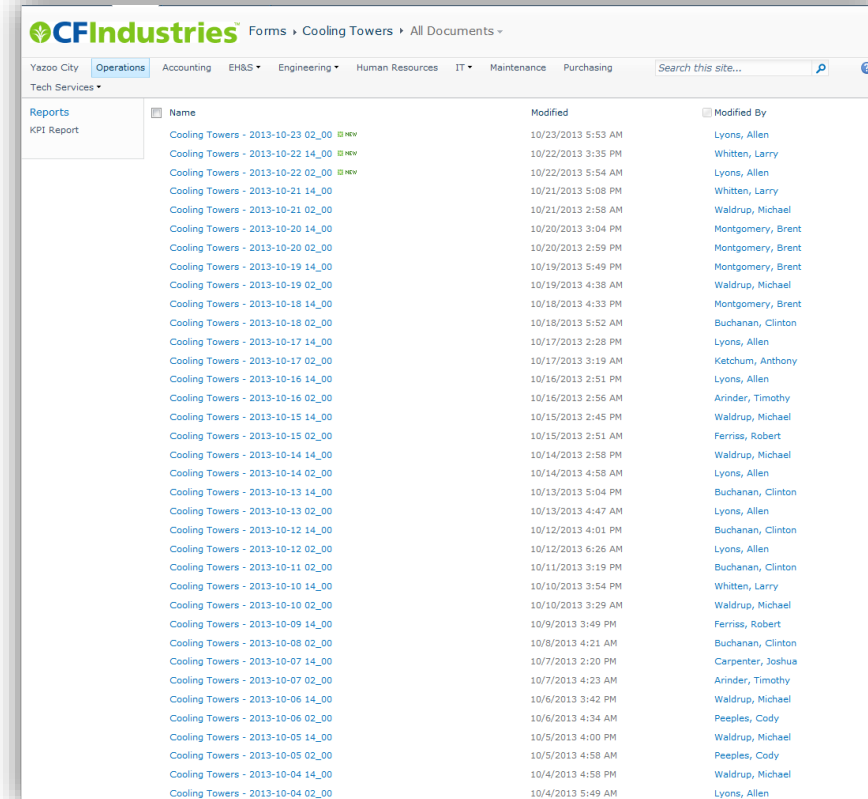
Make Up
SIO2:
aMDEA
Foam Height: mL
Collapse Time: Sec
Anti Foam: mL
New Makeup: Gal

Submit

Notes:
If there is no data for a given cooling tower, leave the fields blank.

Form Based Data Collection (cont.)

- Data entry events are represented by a saved form in the library
- All data can be edited for an event



The screenshot displays the CF Industries Forms library interface. The breadcrumb navigation shows 'Forms > Cooling Towers > All Documents'. The main content area is a table listing various forms, each with a name, a modified date, and a modified by user. The forms are all titled 'Cooling Towers' followed by a date and time stamp. The modified by column lists several users, including Lyons, Allen; Whitten, Larry; Montgomery, Brent; Waldrup, Michael; Buchanan, Clinton; Ketchum, Anthony; Ferriss, Robert; Arinder, Timothy; and Peoples, Cody.

Name	Modified	Modified By
Cooling Towers - 2013-10-23 02_00	10/23/2013 5:53 AM	Lyons, Allen
Cooling Towers - 2013-10-22 14_00	10/22/2013 3:35 PM	Whitten, Larry
Cooling Towers - 2013-10-22 02_00	10/22/2013 5:54 AM	Lyons, Allen
Cooling Towers - 2013-10-21 14_00	10/21/2013 5:08 PM	Whitten, Larry
Cooling Towers - 2013-10-21 02_00	10/21/2013 2:58 AM	Waldrup, Michael
Cooling Towers - 2013-10-20 14_00	10/20/2013 3:04 PM	Montgomery, Brent
Cooling Towers - 2013-10-20 02_00	10/20/2013 2:59 PM	Montgomery, Brent
Cooling Towers - 2013-10-19 14_00	10/19/2013 5:49 PM	Montgomery, Brent
Cooling Towers - 2013-10-19 02_00	10/19/2013 4:38 AM	Waldrup, Michael
Cooling Towers - 2013-10-18 14_00	10/18/2013 4:33 PM	Montgomery, Brent
Cooling Towers - 2013-10-18 02_00	10/18/2013 5:52 AM	Buchanan, Clinton
Cooling Towers - 2013-10-17 14_00	10/17/2013 2:28 PM	Lyons, Allen
Cooling Towers - 2013-10-17 02_00	10/17/2013 3:19 AM	Ketchum, Anthony
Cooling Towers - 2013-10-16 14_00	10/16/2013 2:51 PM	Lyons, Allen
Cooling Towers - 2013-10-16 02_00	10/16/2013 2:56 AM	Arinder, Timothy
Cooling Towers - 2013-10-15 14_00	10/15/2013 2:45 PM	Waldrup, Michael
Cooling Towers - 2013-10-15 02_00	10/15/2013 2:51 AM	Ferriss, Robert
Cooling Towers - 2013-10-14 14_00	10/14/2013 2:58 PM	Waldrup, Michael
Cooling Towers - 2013-10-14 02_00	10/14/2013 4:58 AM	Lyons, Allen
Cooling Towers - 2013-10-13 14_00	10/13/2013 5:04 PM	Buchanan, Clinton
Cooling Towers - 2013-10-13 02_00	10/13/2013 4:47 AM	Lyons, Allen
Cooling Towers - 2013-10-12 14_00	10/12/2013 4:01 PM	Buchanan, Clinton
Cooling Towers - 2013-10-12 02_00	10/12/2013 6:26 AM	Lyons, Allen
Cooling Towers - 2013-10-11 02_00	10/11/2013 3:19 PM	Buchanan, Clinton
Cooling Towers - 2013-10-10 14_00	10/10/2013 3:54 PM	Whitten, Larry
Cooling Towers - 2013-10-10 02_00	10/10/2013 3:29 AM	Waldrup, Michael
Cooling Towers - 2013-10-09 14_00	10/9/2013 3:49 PM	Ferriss, Robert
Cooling Towers - 2013-10-08 02_00	10/8/2013 4:21 AM	Buchanan, Clinton
Cooling Towers - 2013-10-07 14_00	10/7/2013 2:20 PM	Carpenter, Joshua
Cooling Towers - 2013-10-07 02_00	10/7/2013 4:23 AM	Arinder, Timothy
Cooling Towers - 2013-10-06 14_00	10/6/2013 3:42 PM	Waldrup, Michael
Cooling Towers - 2013-10-06 02_00	10/6/2013 4:34 AM	Peeples, Cody
Cooling Towers - 2013-10-05 14_00	10/5/2013 4:00 PM	Waldrup, Michael
Cooling Towers - 2013-10-05 02_00	10/5/2013 4:58 AM	Peeples, Cody
Cooling Towers - 2013-10-04 14_00	10/4/2013 4:58 PM	Waldrup, Michael
Cooling Towers - 2013-10-04 02_00	10/4/2013 5:49 AM	Lyons, Allen

Plant KPI's

- DCS Data
- Form Based Data
- Wireless Manual Data
- PI ACE
- SQL Server
- Administered via SharePoint

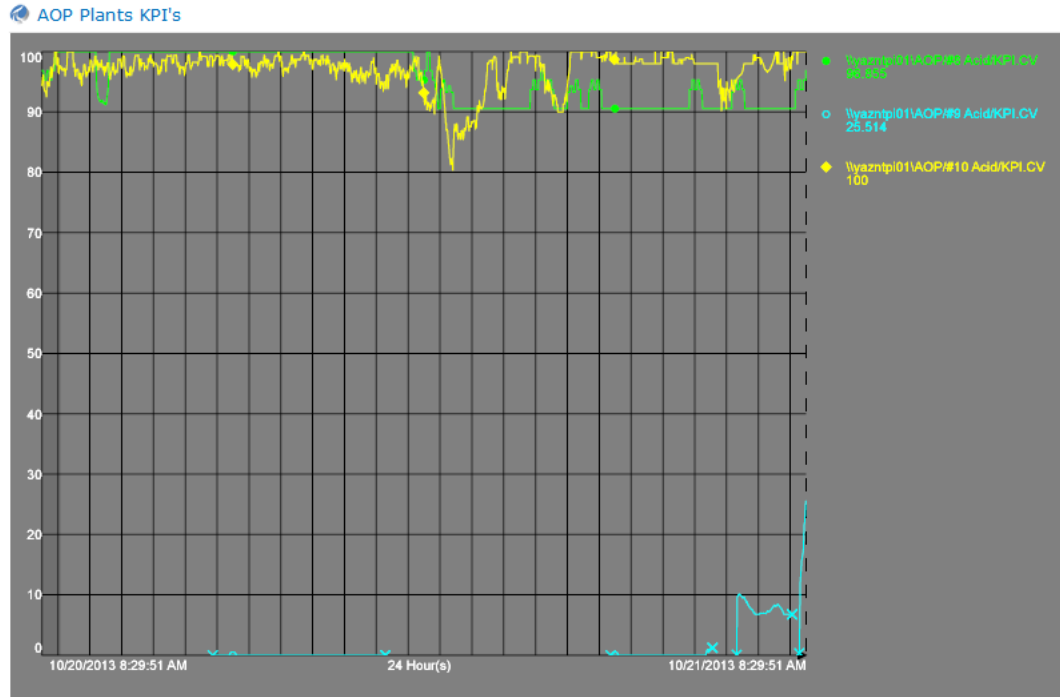
Plant KPI's (cont.)

- InfoPath form created for each KPI
- KPI parameters are editable and KPI calculation reflects changes instantly

The screenshot shows a web-based form for editing KPI tags. The form is titled "#8 AOP Operations KPI Tag Master Sheet" and is associated with "CF Industries". It contains several KPI entries, each with a unique ID, a description, a weight, an upper limit, and a lower limit. Each entry has "Update" and "Edit Comments" buttons.

ID	Description	Weight	Upper Limit	Lower Limit
ACID08AU141A1800PV	Stack NOx	10	200	150
ACID08AU141FI1831PV	Product Flow from Tower	4	300	100
AOP/#8 ACID/FFIC-1895/PID1/PV.CV	Ratio	10	10.3	9.6
AOP/#8 ACID/FI-1812/A11/PV.CV	Process Air Flow	8	400000	330000
AOP/#8 ACID/FI-1813/A11/PV.CV	Bleach Air Flow	10	80000	50000
AOP/#8 ACID/FI-1821/A11/PV.CV	Steam to Turbine	3	70000	45000
AOP/#8 ACID/FI-1895/A11/PV.CV	NH3 Flow to the Gauze	10	26100	20000
AOP/#8 ACID/FIC-1804/PID1/PV.CV	Condensate to the Tower	3	40	15

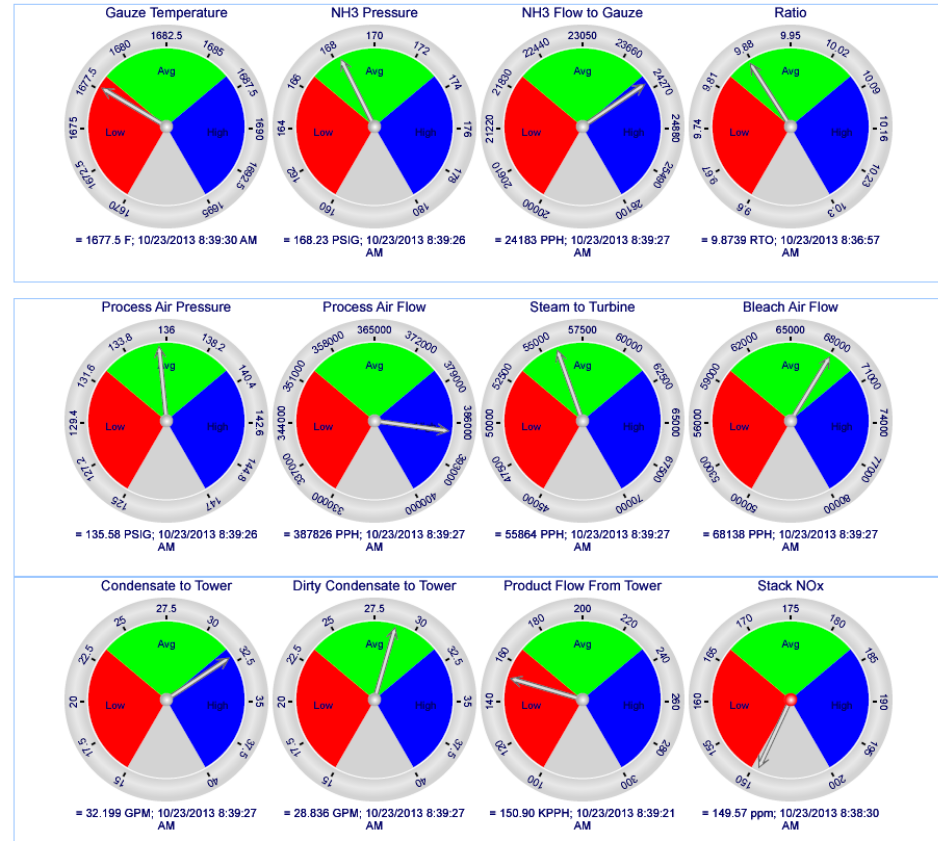
Plant KPI's (cont.)



Plant KPI's (cont.)

- PI Gauge web part is used for troubleshooting
- Limits of gauges are set by the KPI form

#8 AOP KPI's



Wireless Manual Data

- WMD tags are created using an InfoPath form
- All WMD tags are represented by a saved form in the library

The screenshot shows a web-based form titled "WiRe PI Point Utility for #3 NH3" within a browser window. The browser's address bar shows "Edit". The form includes a toolbar with "Close", "Paste", "Cut", and "Print Preview" buttons. Below the toolbar are "Commit", "Clipboard", and "Views" buttons. The CF Industries logo is displayed at the top left of the form area. The form fields include:

- Tag: Select... (dropdown)
- Barcode #: (text input)
- Description: (text input)
- Zero: (text input, value 0)
- Span: (text input, value 100)
- Engr. Units: Select... (dropdown)
- Datatype: Numeric, Text
- Station: Select... (dropdown)
- Lower Limit: (text input, value 0)
- Upper Limit: (text input, value 100)
- Frequency: Select... (dropdown) hrs.
- Response Set: (text input, value 0)

Response Sets:

1. High, Normal, Low
2. Ok, NotOk

Buttons: Create, Edit

Note:
If a tag needs to be deleted. Email Yazoo.IT with the tag number. IT will email back with the confirmation.

Wireless Manual Data (cont.)

CF Industries Forms > WiRe > All Documents

Yazoo City Operations Accounting EH&S Engineering Human Resources IT Maintenance Purchasing Search this site...

Tech Services

Reports
KPI Report
Count= 175

Name	Barcode	PI Descriptor	PI Frequency	Station
AI-1001	1338	H2S Analyzer Ni-Moly Out ppm	8	Station1
AI-1002	1337	H2S Analyzer 1st Zinc Out ppm	8	Station1
AI-1003	1336	H2S Analyzer 2nd Zinc Out ppm	8	Station1
AI-1004	1335	H2S Analyzer 3rd Zinc Out ppm	8	Station1
AI-1005	1334	H2S Analyzer D-14 Top PPM	8	Station1
AI-1006	1333	H2S Analyzer D-14 Mid ppm	8	Station1
AI-1007	1332	H2S Analyzer D-14 Bottom ppm	8	Station1
AI-1008	1331	H2S Analyzer Ni-Moly Out ppb	8	Station1
AI-1009	1330	H2S Analyzer 1st Zinc Out ppb	8	Station1
AI-1010	1329	H2S Analyzer 2nd Zinc Out ppb	8	Station1
AI-1011	1328	H2S Analyzer 3rd Zinc Out ppb	8	Station1
AI-1012	1327	H2S Analyzer D-14 Top ppb	8	Station1
AI-1013	1326	H2S Analyzer D-14 Mid ppb	8	Station1
AI-1014	1325	H2S Analyzer D-14 Bottom ppb	8	Station1
EI-1001	1448	Emergency Generator Volts	8	Station1
EI-1002	1394	Provox UPS A.C. Volts	12	Station1
EI-1003	1393	Provox UPS D.C. Volts	12	Station1
FI-1001	1402	BW-6000 #1 Boiler DEHA Flow Rate	12	Station1
FI-1002	1401	BW-6000 #2 Boiler DEHA Flow Rate	12	Station1
FI-1003	1400	BW-8060 #1 Boiler Amine Flow Rate	12	Station1
FI-1004	1399	BW-8060 #2 Boiler Amine Flow Rate	12	Station1
FI-1005	1398	BW-5005 1500# Boiler Phosphate Flow Rate	12	Station1
FI-1006	1397	BW-9005 1500# Boiler Caustic Flow Rate	12	Station1
FI-9020	1383	Mix Bed Flow Rate	2	Station1
FI-97	1380	Condensate Polisher #1 Flow:	4	Station1
FI-98	1377	Condensate Polisher #2 Flow	4	Station1
FQI-9001	1388	A Cation Total Gallons	2	Station1
FQI-9002	1387	B Cation Total Gallons	2	Station1
FQI-9003	1386	C Cation Total Gallons	2	Station1
FQI-9004	1385	D Cation Total Gallons	2	Station1

1 - 30

+ Add document

Wireless Manual Data (cont.)

- Aluminum Barcode
 - .020 Thick
 - Text and Barcode is embedded .005



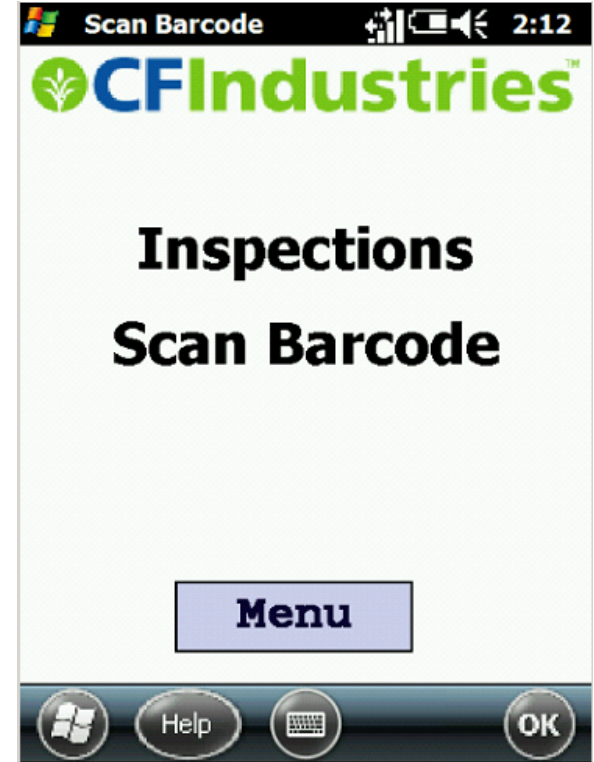
Wireless Manual Data (cont.)

- eCom i.roc® Ci70 – Ex
- Class I Div I Groups A-G
- Windows Embedded OS
- MobiControl – Device Management
- Bright Software – Data Collection
- Administered via SharePoint
- K.eep I.t S.imple



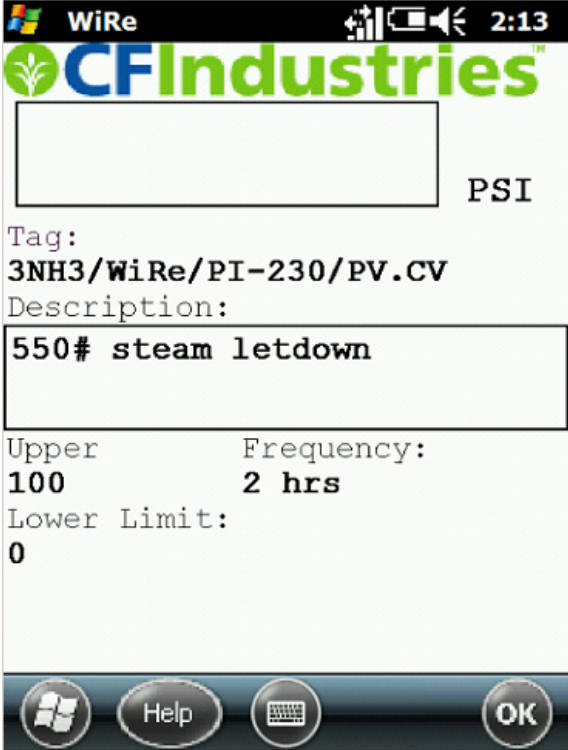
Wireless Manual Data (cont.)

- Home Screen
- Within wireless coverage, the handheld will sync every 1 min
- GUI administration is done via BrightForms utility



Wireless Manual Data (cont.)

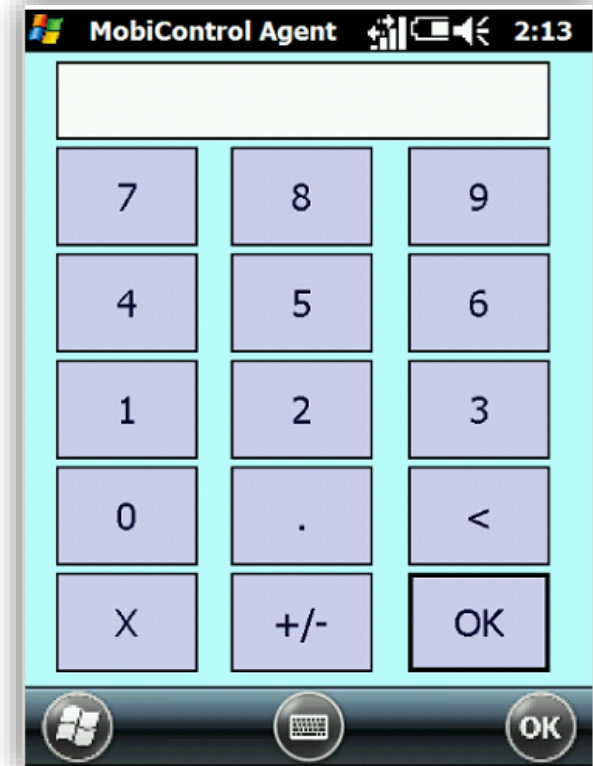
- Data Entry Screen
 - Notification of upper/lower limit exceedance
 - Frequency of inspection
 - Logically concludes timestamp
- Using PI Interface for RDMS allows operators to record data that is time-stamped in the future



The screenshot shows the 'WiRe' mobile application interface. At the top, the status bar displays 'WiRe', signal strength, battery level, and the time '2:13'. Below the status bar is the 'CF Industries' logo. The main screen features a large empty text input field. To the right of this field is the label 'PSI'. Below the input field, the text 'Tag: 3NH3/WiRe/PI-230/PV.CV' is displayed. Underneath the tag is the 'Description:' field, which contains the text '550# steam letdown'. Below the description, the 'Upper' limit is set to '100' and the 'Frequency' is '2 hrs'. The 'Lower Limit:' is set to '0'. At the bottom of the screen, there is a navigation bar with four circular icons: a Windows logo, 'Help', a keyboard icon, and 'OK'.

Wireless Manual Data (cont.)

- Data entry is finger friendly
 - No stylus is needed



Wireless Manual Data (cont.)

- Inspection Sheet
- Operators can review data entered
- Reference for barcodes
- PI DataLink Server

CF Industries #3 NH3 Plant ▸ Inspection_Sheets ▸ 3NH3_BoardSheet_1.xlsx

File Open in Excel Data Find

Date: 10/23/2013

Time	PRESSURE			STACK	FAN IN			MIX FLUE		AUX FLUE	PRIM SEC	CONV OUT	FLUE GAS EXIT	
	IN	OUT	DIFF PDI		50	51	52	53	54	55	56	S.H. COIL		
	PI-7	PI-8	55									HOT LEG		
Barcode	1489-S1	1488-S1	Calc.										TI259	TI260
12M														
2														
4														
6														
8														
10														
12N														
2														
4														
6														
8														
10														
12M														

Future of PI System @ CF – Yazoo City

- Mobility
 - Smart Phones
 - Tablets
- PI System integration with EAM software
 - Automation of PM work orders
- Create elements in PI AF and have PI Notification option on the form used to create tags for Wireless Manual Data
- Build out all KPI's needed to produce a single KPI for the entire complex

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Network Supervisor

CF Industries Inc.



THANK

YOU

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Questions?