

# Make a difference – Go “Beyond” Scada

Presented by: Rudy Engert – Infrastructure Business Manager - Wonderware

# Very SIMPLE Mission Statement...



## SAFEGUARD PUBLIC HEALTH

- Safe drinking water
- Fire protection
- Water pollution control



## ENSURE CUSTOMER SATISFACTION

- Adequate and reliable supply
- Appropriate water quality
- Appropriate prices (*toward financial sustainability*)



## PROTECT THE ENVIRONMENT

- Adequate and reliable supply
- Appropriate water quality
- Efficient use of supplies for minimum impacts  
(*toward environmental sustainability*)



There is no substitute for water

*Very COMPLICATED issues as a result...*

- **Compliance with State/Federal Regulations**

- Population growth is pushing us near our permitted capacity




“The truth is,  
there is only one  
driver in the  
water business.  
**It is crisis.”**

C. Gasson, Editor, GWI  
Apr 2015

Life Is On

**Schneider**  
Electric

A city skyline, likely New York City, is visible in the background under a hazy, orange sky. The foreground is dominated by a vast, cracked, and dry landscape, suggesting severe drought or desertification.

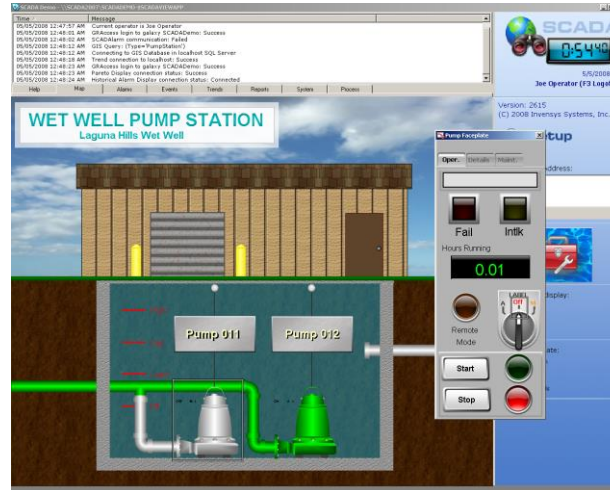
Governments “typically” want to react to crisis, which is fair EXCEPT when it comes to water

Life Is On

Schneider  
Electric

# HMI SCADA is a critical part of the solution...

- SCADA sets the foundation for operation, visualization, notification and control
- SCADA is an essential part of any water operation process
- The information from devices is critical to understanding how your operations run
- As important as this solution is, it is relegated to low bid, minimal functionality, thereby low value.
- Almost all facilities have HMI, in fact even some individual devices do to. Data silos, no context, IoT..?



# What is data...?

**Data** : facts or information used to calculate, analyze or plan something

Source : [www.merriam-webster.com/dictionary/data](http://www.merriam-webster.com/dictionary/data)

Piece of Data



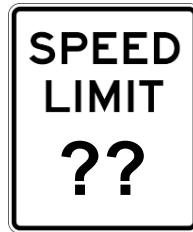
Level of Knowledge



Possible Outcome



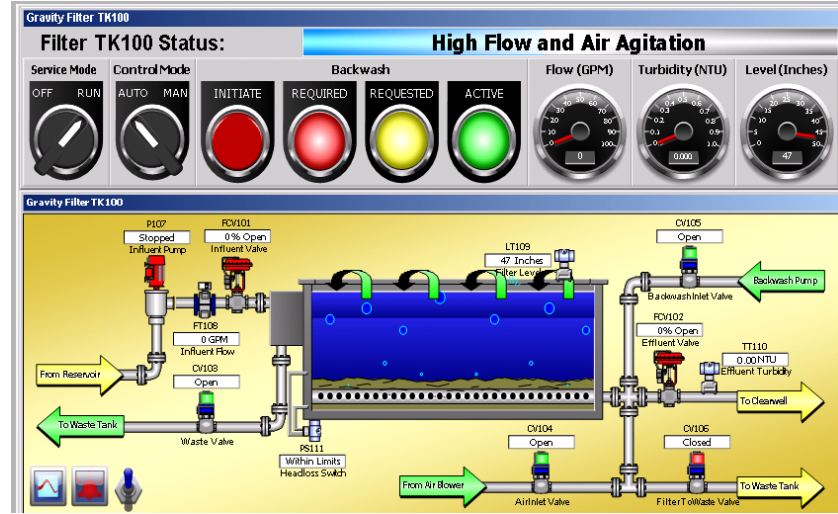
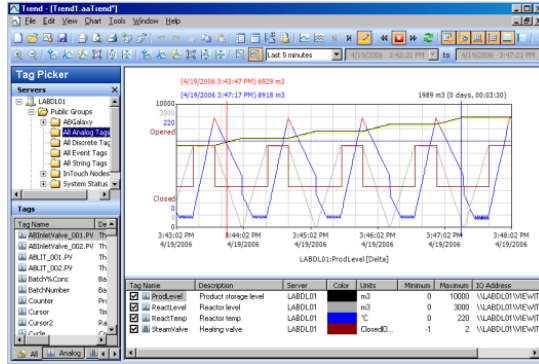
Data, without information (or context) is useful, but will not solve your problems



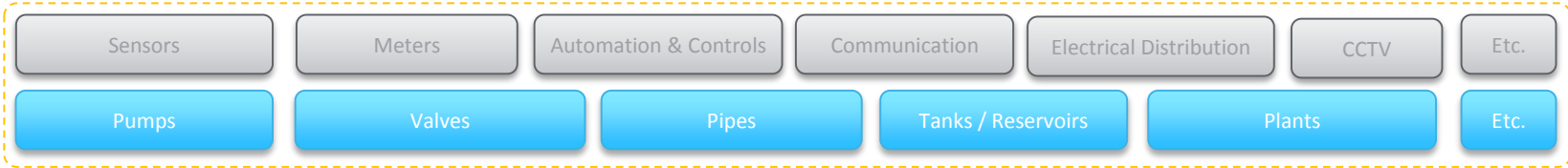
Life Is On

**Schneider**  
Electric

# Where does this "DATA" come from...?



Hardware





and this is where the industry usually stops...



Life Is On


Schneider  
Electric

## *Making a better operator...*

- What keeps operators up at night..?
  - Regulatory concerns
    - Proper nutrient levels / residual chlorine / dissolved oxygen
  - Circumstances beyond their control
    - Climate / Storm runoff / crumbling infrastructure
  - And, when bad things happen
    - no time for the manual - TROUBLESHOOT

*Using Situational Awareness, embedded Workflows and predictive maintenance...*

How do I get there?

NEXT EXIT 

Fortunately, you only need to do what you are already doing, just a bit differently... it starts with data...

Life Is On

**Schneider**  
Electric

# Situational Awareness...

Data in context – BUILD the TROUBLESHOOTING in to the application

# Impact of Human Error

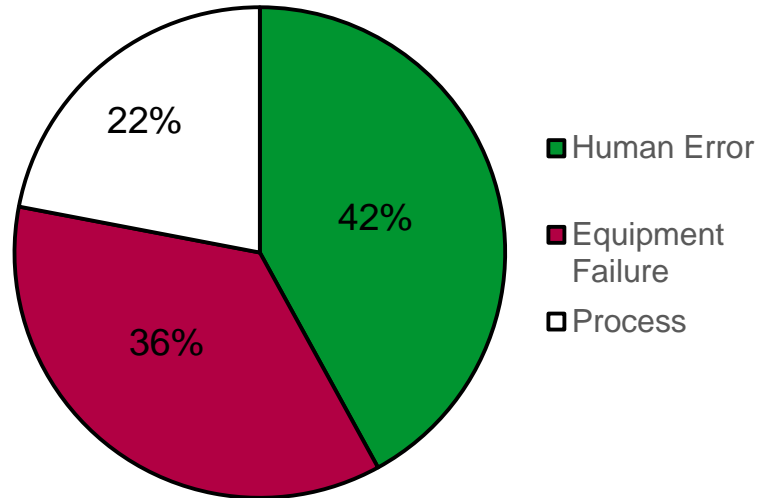
## Abnormal Situation

A disturbance or series of disturbances in a process that cause plant operations to deviate from their normal operating state.

The average percentages shown had the following:  
•People and work Context Factors: 35% - 58%  
•Equipment Factors: 30% - 45%  
•Process Factors: 3% - 35%

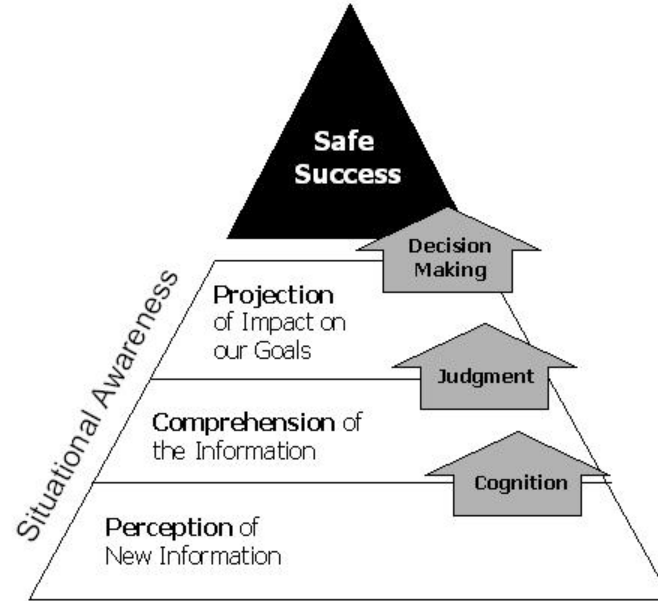
Source: ASM Consortium

## Abnormal Situation Causes

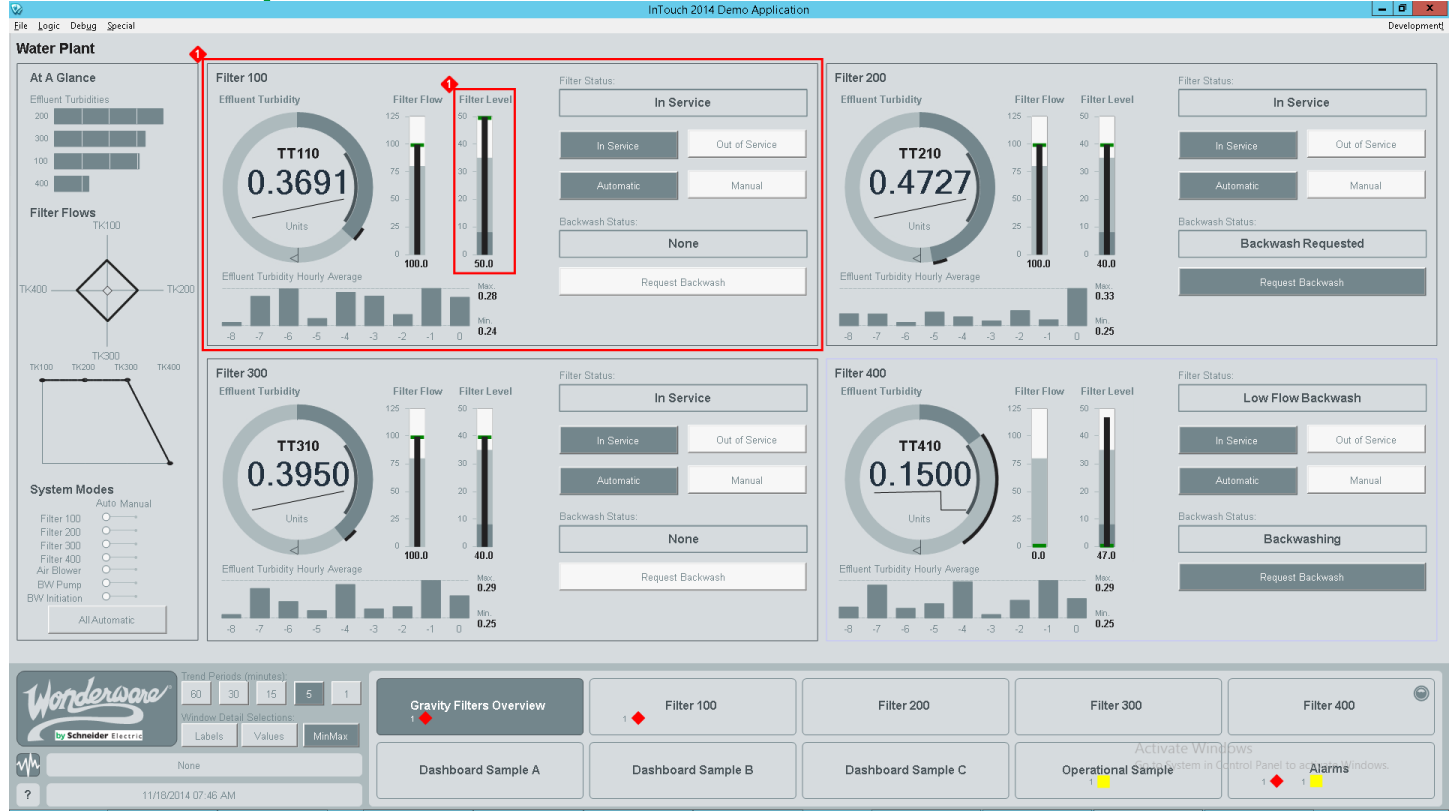


# Situational Awareness

The perception of environmental elements with respect to time and/or space, the comprehension of their meaning, and the projection of their status.



# Process Graphics Evolution



# Support Fast Visual Inspection

How would you handle this?

How about this?

You are using Pre-Attentive Processing.





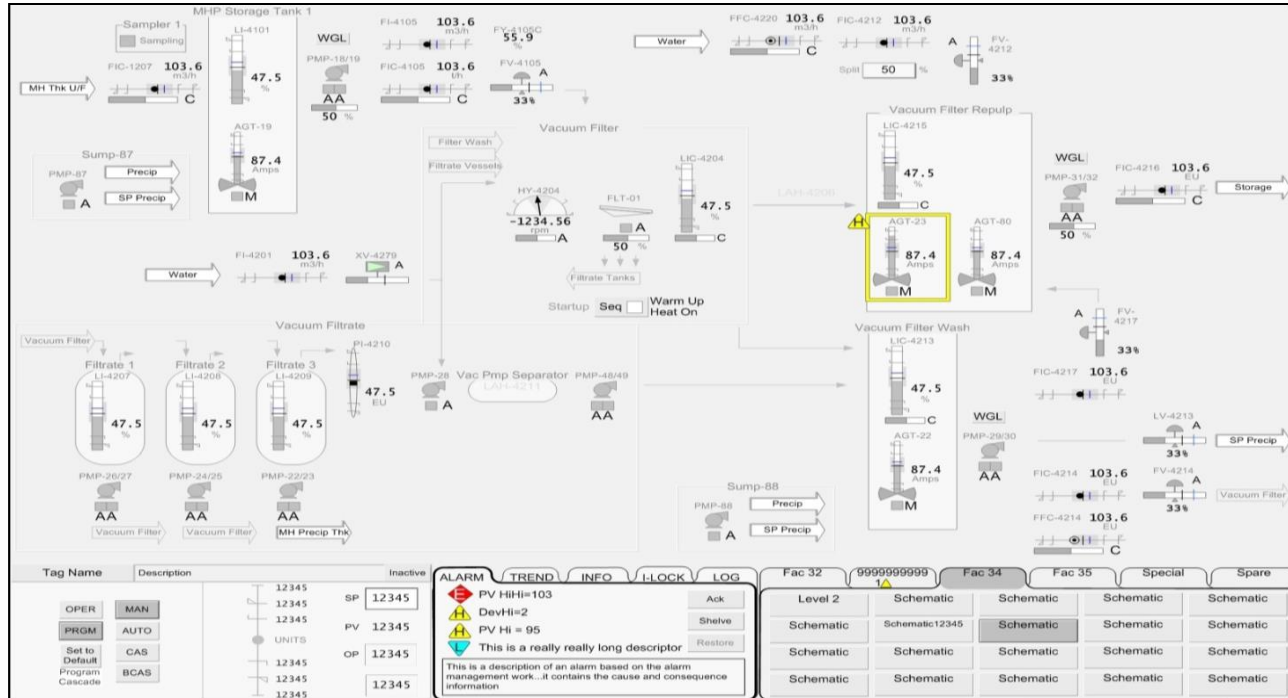
# Pre-Attentive Processing Attributes

The image displays 11 examples of pre-attentive processing attributes, each within a rectangular frame:

- Color Hue:** A 3x5 grid of 15 gray circles, with the circle in the second row, fourth column highlighted in red.
- Color Intensity:** A 3x5 grid of 15 circles, with the circle in the second row, second column highlighted in black.
- Shape:** A 3x5 grid of 15 circles, with the circle in the second row, second column replaced by a gray star.
- Line Length:** Five vertical lines of varying lengths, with the fourth line from the left being the shortest.
- Enclosure:** A 3x5 grid of 15 circles, with the circle in the second row, fourth column enclosed in a square box.
- Orientation:** A 3x5 grid of 15 downward-pointing arrows, with the arrow in the second row, fourth column rotated 45 degrees clockwise.
- Line Width:** Five vertical lines of equal length, with the fifth line from the left being significantly thicker than the others.
- Spatial Position (2D):** Five circles arranged in a horizontal line, with the second circle from the right being positioned higher than the others.
- Added Marks:** Five vertical lines of equal length, with a plus sign (+) centered between the third and fourth lines.
- Size:** A 3x5 grid of 15 circles, with the circle in the second row, second column being much larger than the other circles.

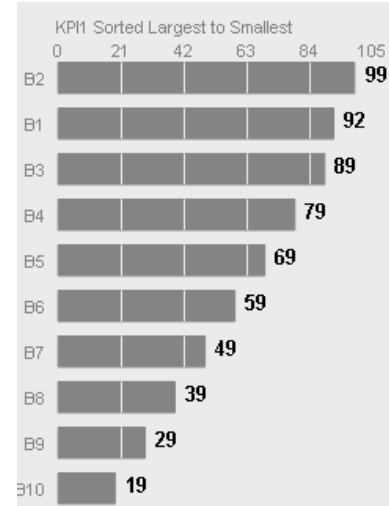
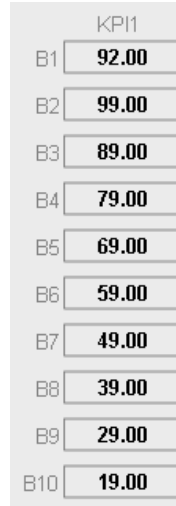
# Applying Color – Hue & Enclosure

- Watch for the alarm...

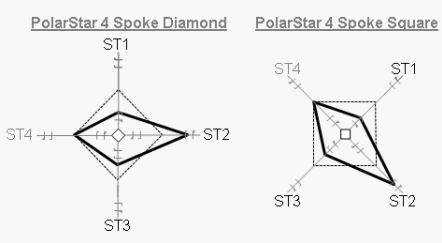
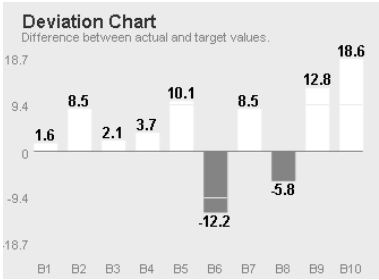
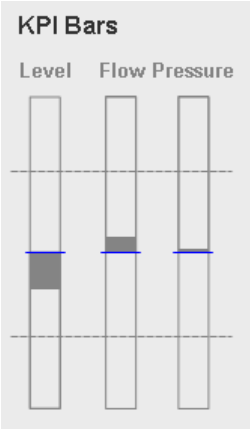
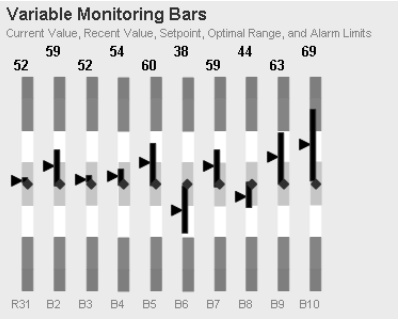
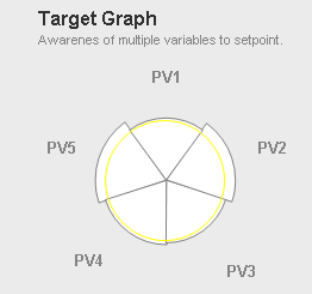


# Line Length

What value is the largest?  
What value is the smallest?  
  
How about now?



# Deviation From Target



# Meter Components

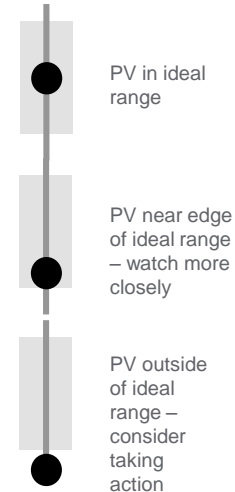
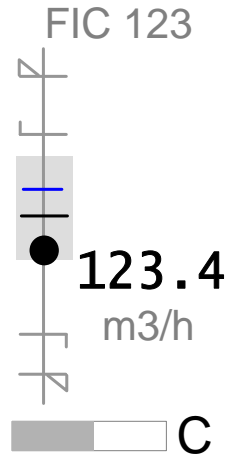
## Glance Test

When you click, an example will appear briefly at the far right of the screen – see if you can tell whether the PV is inside the optimal range or not

*Click  
again...*

*And again...*

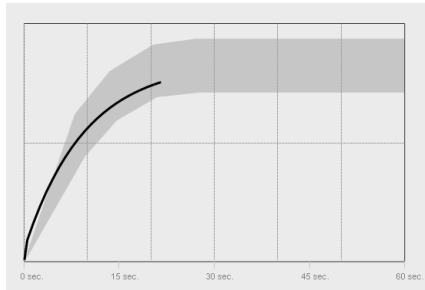
Each example was only shown for ½ of a second



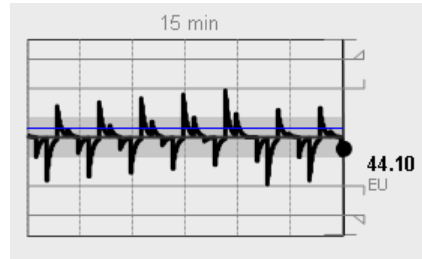
# Trends

- Trends are effective for attaining Level 3 SA – Projection.

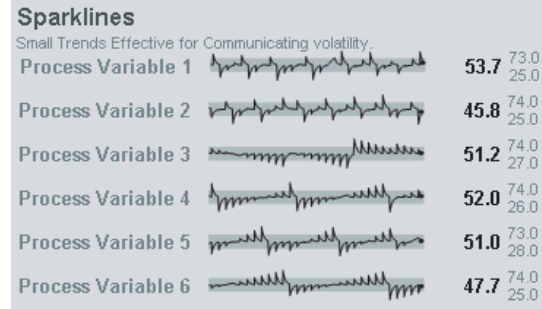
Start-Up Curve



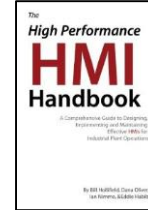
Trend Tail



Sparklines

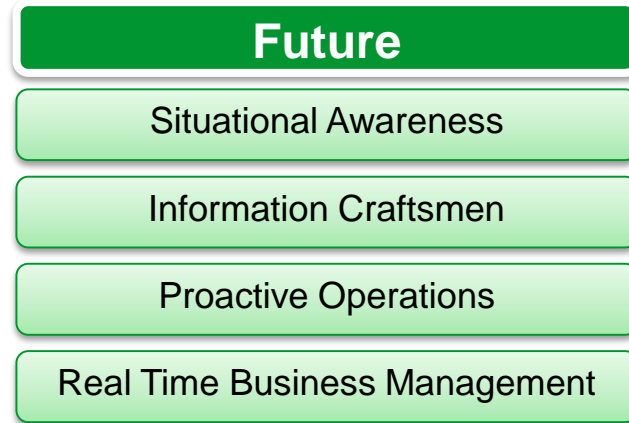
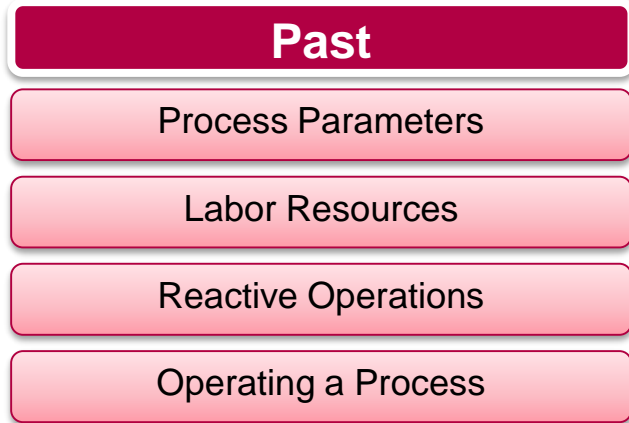


# Benefits...



Task	With Traditional HMI	With High Performance HMI	Result
Detecting Abnormal Situations before alarms occur	10% of the time	48% of the time	A 5X increase
Success rate in handling abnormal Situation	70%	96%	37% over base case
Time to complete abnormal situation tasks	18.1 min	10.6 min	41% reduction

# Evolving Industrial Operations





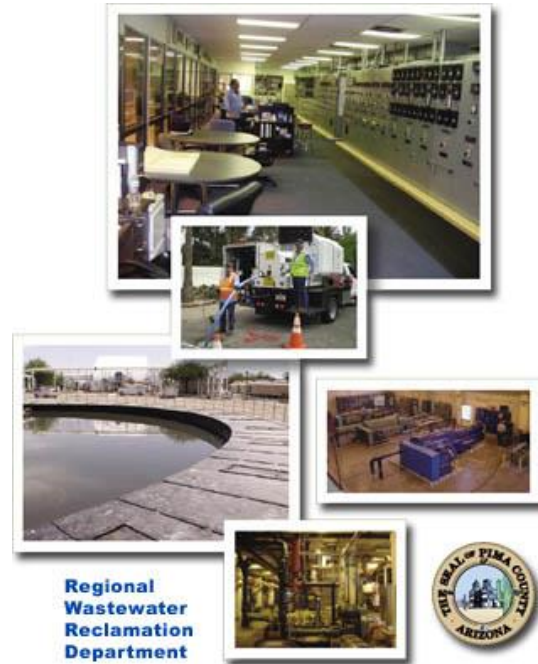
# Embedded Workflows and Stranded Asset Data...

Data in context – you don't need manuals when you can BUILD your SOP's into the application...

# Pima County - Regional Wastewater Reclamation

## The Problem:

- Manual Rounds
- Poor ability to visualize information
- No guarantee of round completion
- Data Entry Labor
- Data Entry Delay
- Data Entry Mistakes



# Part of the Problem - The Rounds Sheets...

Area # 7 Air Blowers & Grit Pumps

DATE 1-10-13 BUIL \_\_\_\_\_

DATE 1-10-13

MIDS HARRIS

TIME	2400	0400
RAW INF LEL	0	0
RAW INF HZS	3.6	.3
COARSE BAR SCREEN	ON/OFF	ON/OFF
SCREEN 1	ON	ON
SCREEN 2	-	-
TIMER (ON/OFF)	OFF	OFF
CONVEYOR	CHD/OK	CHD/OK
Conveyor oil	CHD/OK	CHD/OK
Hopper level	FEET	FEET
SCREW PUMP	FEET	FEET
INLET LEVEL	2.07	1.0

Emer

Overflow To	(Yes/No)	(Yes/No)
Pond	N/D	N/D
Pond #2 Level	N/T	N/T
Return Valve	OPEN/CLOSED	OPEN/CLOSED
From #2 to #1	CLOSED	CLOSED
Pond #3 Level	CLOSED	N/T
Return Valve	OPEN/CLOSED	OPEN/CLOSED
From #3 to #1	CLOSED	CLOSED
RPM	OFF	OFF
Vacuum		
Fuel Level	↓	↓

Comments: \_\_\_\_\_

Time:	MIDS			Days			SWINGS		
	2400	0400	0800	1200	1600	2000	psi	psi	psi
Process air manifold	2.04	2.34	2.02						
Air blower #1 on/off	OFF		OFF						
Air blower #1 (vacuum)									
Air blower #1 receiver									
Air blower #2 on/off	OFF		OFF						
Air blower #2 (vacuum)									
Air blower #2 receiver									
Air blower #3 on/off	ON	ON	ON						
Air blower #3 (vacuum)	0	.1	0						
Air blower #3 receiver	5.2	5.2	4.9						
Air blower #4 on/off	OFF		OFF						
Air blower #4 (vacuum)									
Air blower #4 receiver									

Grit Pump	Grit Pumps		
	2400	0400	0800
Grit pump #1 (loc/remote)	ON	ON	ON
G.P.#1 seal water	OK	OK	OK
G.P.#1 packing ck'd/ok	OK	OK	OK
G.P.#1 inlet psi	2	2	2
G.P.#1 outlet psi	15	16	14
Grit pump #2 (loc/remote)	OFF		OFF
G.P.#2 seal water			
G.P.#2 packing ck'd/ok			
G.P.#2 inlet psi			
G.P.#2 outlet psi			
Grit pump #3 (loc/remote)	ON	ON	ON
G.P.#3 seal water	OK	OK	OK
G.P.#3 packing ck'd/ok	OK	OK	OK
G.P.#3 inlet psi	1	1	1
G.P.#3 outlet psi	15	15	14
Grit pump #4 (loc/remote)	OFF		OFF
G.P.#4 seal water			
G.P.#4 packing ck'd/ok			
G.P.#4 inlet psi			
G.P.#4 outlet psi			
Grit pump #5 (loc/remote)	OFF		OFF
G.P.#5 seal water			
G.P.#5 packing ck'd/ok			
G.P.#5 inlet psi			
G.P.#5 outlet psi			
Seal water for grit pump	P/S	P/S	P/S

Truck Bay Sump	P/S					
	ck'd/ok	ck'd/ok	ck'd/ok	ck'd/ok	ck'd/ok	ck'd/ok
sump pump #1	OK	OK	OK	OK	OK	OK
run time hours	2125.7	2125.9	2125.1			
sump pump #2	OK	OK	OK	OK	OK	OK
run time hours	2126.6	2126.5	2127.2			

PUMP DOWN SUMP TO THE LOW LEVEL ALARM ONCE PER SHIFT. DO NOT LEAVE PUMP UNATTENDED.  
 ✓ 0746

Area # 5 Fine Screenings

DATE HARRIS

DATE \_\_\_\_\_

MIDS \_\_\_\_\_

	MIDS			Days			SWINGS		
	0400	0800	1200	1600	1800	2000	psi	psi	psi
00									
01	ON	ON							
02	ON	ON							
03		OFF							
04		OFF							
05	ck'd/ok	ck'd/ok	ck'd/ok	ck'd/ok	ck'd/ok	ck'd/ok			
06	Hand	Hand							

HUBER WASHER / COMPACTORS

Physically check washer / compactor and hopper every round

	Auto				
	1/2 / Auto	1/2 / Auto	1/2 / Auto	1/2 / Auto	1/2 / Auto
07	1/2 Auto	AUTO			
08	ck'd/ok	ck'd/ok	ck'd/ok	ck'd/ok	ck'd/ok
09	OK	OK			
10	OK	OK			
11	feet	feet	feet	feet	feet
12	1.0	1.2			
13	Timer	Timer	Timer	Timer	Timer
14	on/off	on/off	on/off	on/off	on/off
15	ON	ON	11:35/5:00		
16	ON	ON	11:35/5:00		
17	OFF		OFF		
18	psi	psi	psi	psi	psi
19	6.2	3.2			
20	6	6.2			
21	0.5				
22	feet	feet	feet	feet	feet
23	1.52	2.8			

# Digitizing the Headwork's Round...

The screenshot displays the IntelTrac Management Center software interface, specifically the Procedure Builder tool. The interface is divided into several sections:

- Navigation Panel (Left):** Contains various management and reporting tools such as Content Management, Scheduling, Workstation, Review, Reporting, Administration, and Documentation.
- Procedure Builder (Center):** The main workspace for creating and editing procedures. It features a 'Locator' on the left with a tree view of categories like Air Separation, API Inspections, Environmental, Fire & Safety, Food & Beverage, Mining, Paper & Pulp, Power Generation, Refining & Chemical, Testing, and Water & WasteWater. Under 'Operations', there are items like 'Fine Screenings' (with a green checkmark icon) and 'Grit Pumps and Air Blowers' (with a yellow sun icon). A blue button labeled 'Headworks' is highlighted at the bottom of this list.
- Toolbox (Right):** A vertical panel containing various actions and integrations, including Procedure Items (Task Group, Decision, Task, Condition), Actions (Force Calculation, Jump, Message, Note, Launch Procedure, Work Order Request), Integrations (Production Data, Experion, IP21, OSI, PHD, Wonderware Historian, Wonderware Galaxy, IntelTrac Tag), and Peripherals (RFID, VIBTOOL, Barcode, SKF@ CMVL3600-IS MCD Prol, Cyclops 100 / 390 Temperatu, Raynger MX4 Series Tempera).

# Headwork's Round - old & new...

BUILDING 30: HEADWORKS

DATE 1-10-13

MIDS HARRIS Days HARTMAN SWINGS

TIME:	2400	0400	0800	1200	1600	2000
RAW INF LEL	0	0	0			
RAW INF H2S	3.6	.3	0.3			
COARSE BAR SCREEN						
COARSE BAR SCREEN	ON/OFF	ON/OFF	ON/OFF	ON/OFF	ON/OFF	ON/OFF
SCREEN 1	on	on	on			
SCREEN 2	-	-	OFF			
TIMER (ON/OFF)	OFF	OFF	MANUAL			
CONVEYOR	CH'D/OK	CH'D/OK	CH'D/OK	CH'D/OK	CH'D/OK	CH'D/OK
	OK	on	✓OL			
Conveyor oil	CH'D/OK	CH'D/OK	CH'D/OK	CH'D/OK	CH'D/OK	CH'D/OK
	OK	on	✓OL			
Hopper level	FEET	FEET	FEET	FEET	FEET	FEET
	2.07	2.0	2.5			
SCREW PUMP	FEET	FEET	FEET	FEET	FEET	FEET
INLET LEVEL	<sup>MH</sup> 2.07 1.45	1.0	0.9			

Emergency Overflow Ponds

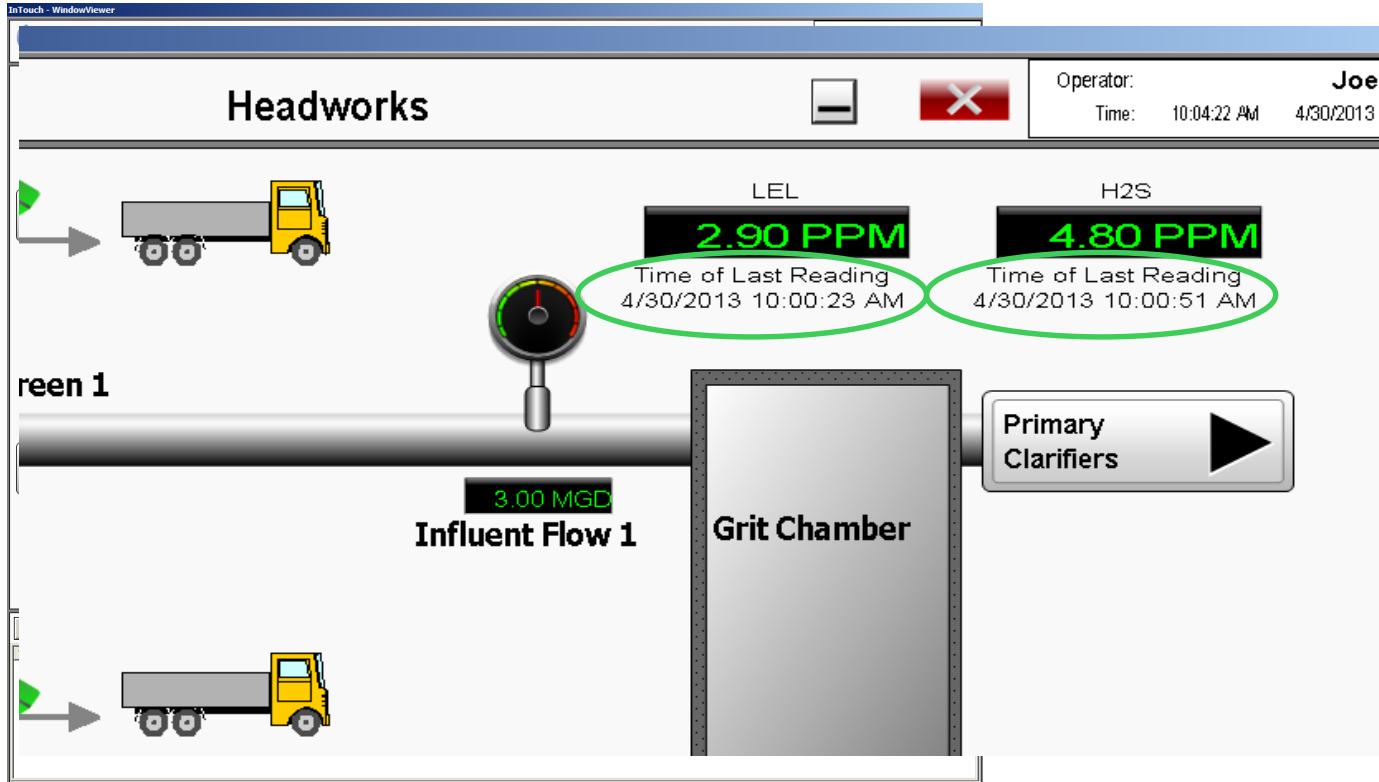
As Examples:

- Hydrogen Sulfide
- Lower Explosive Limit

Life Is On

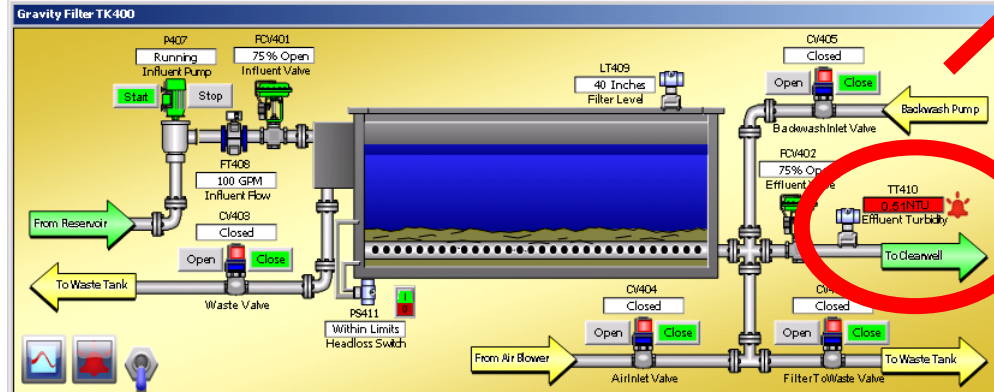
Schneider  
Electric

# Post Round Stranded Data – Synched to SCADA...



# The Alarm Occurs...

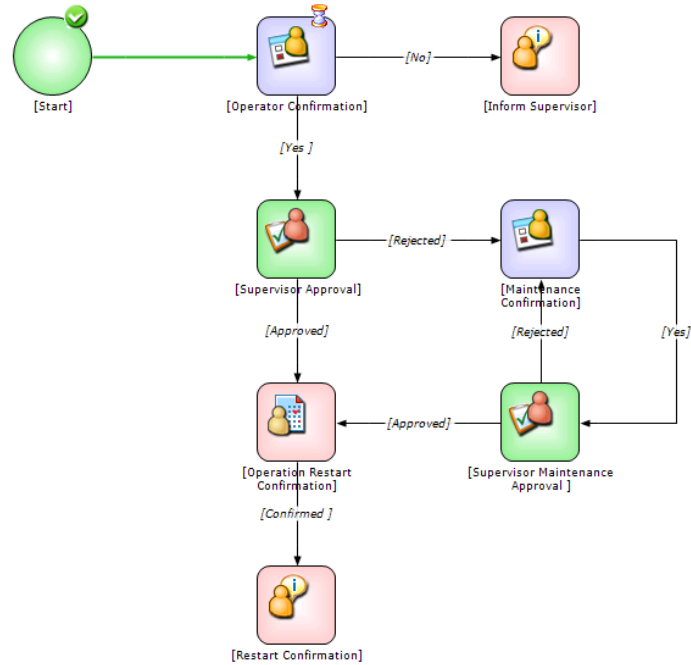
Time	State	Type	Class	Priority	Name	Group	Lock	Posible
5/20/13 10:57:47 AM	ONCK	H	VALVE	1	TT1104	TK400	Low	globe



## Workflow begins...



# The Workflow In Action...





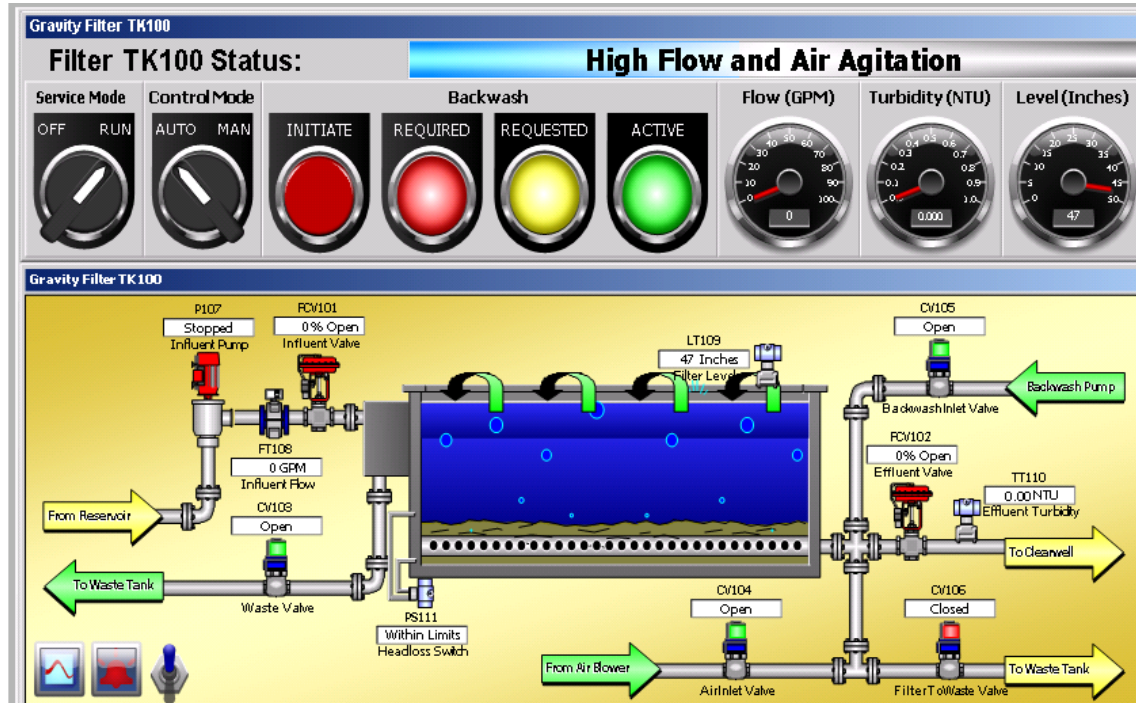
# What the Operator See's...

The screenshot displays a software interface for an industrial control system. The main window is titled "WorkItem Detail View" and contains the following elements:

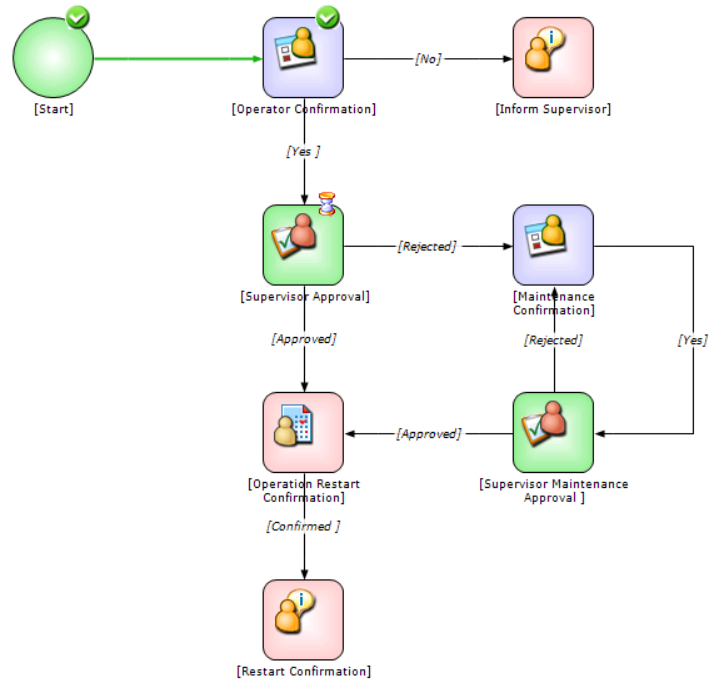
- Header:** "Manage Work item: (Operator Confirmation): Take Ownership" with a "Go" button.
- Section:** "Environment Hazard - Confirm steps".
- Text:** "Please confirm the area is clear of any environment hazard ---Detected High Turbid water in the effluent outlet for tank TK100.EffluentTurbidity."
- Form Fields:**
  - "Have you Turned the system from Manual to Auto Mode \*": Yes (dropdown)
  - "What is the Water level reading?": 40 (text input)
  - "Is the Backwash valve open?": Yes (dropdown)
- Action:** "Submit" button at the bottom right.

The interface also features a left-hand navigation tree with items like "LiftSt", "Water", "Co", "Fil", "Syste", and "Thin". The right-hand panel includes a clock, two gauges for "Turbidity (NTU)" and "Level (Inches)", and a process diagram showing components like "Backwash Pump", "RC102", "Fluent Valve", "TT110", "To Cleanwell", "To Waste Tank", and "Filter/Turbidity Valve". A "Control Mode" selector is set to "MAN". The user name "Joe Operator" is visible at the bottom right.

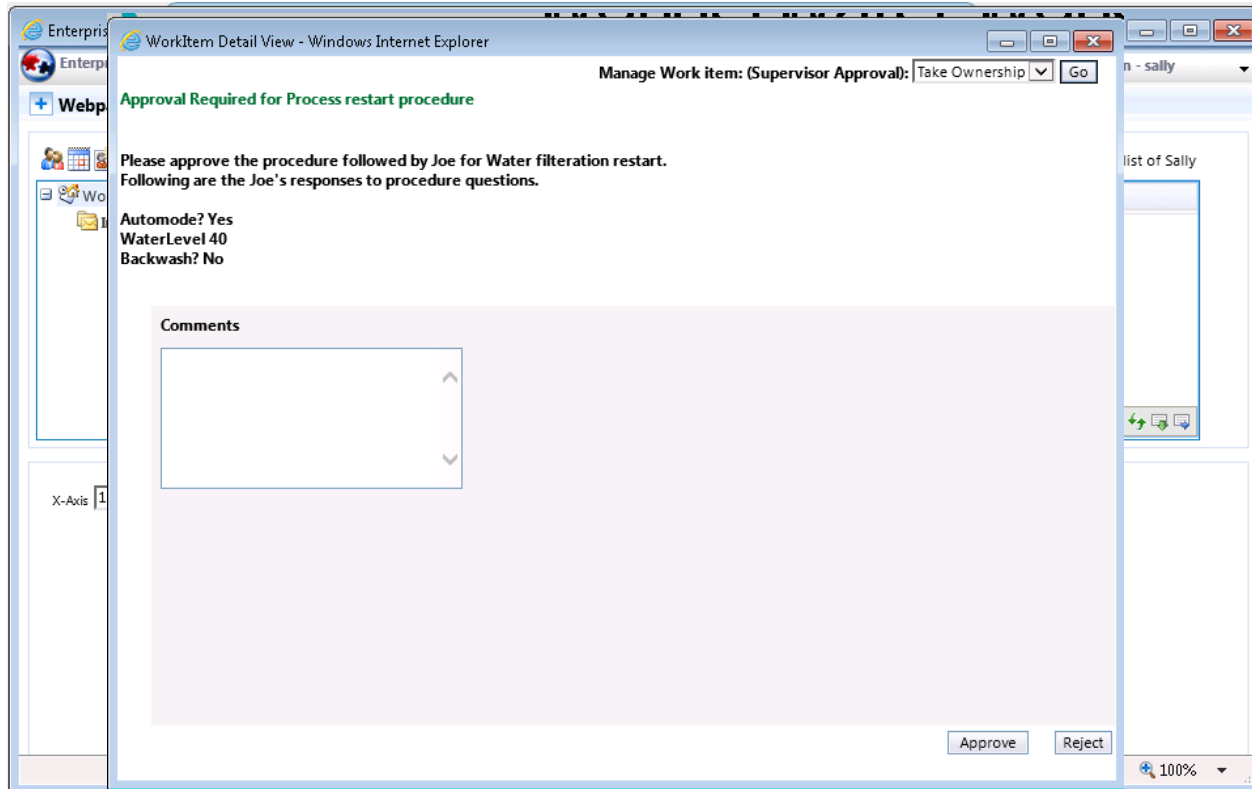
# Operator maintains operational control...



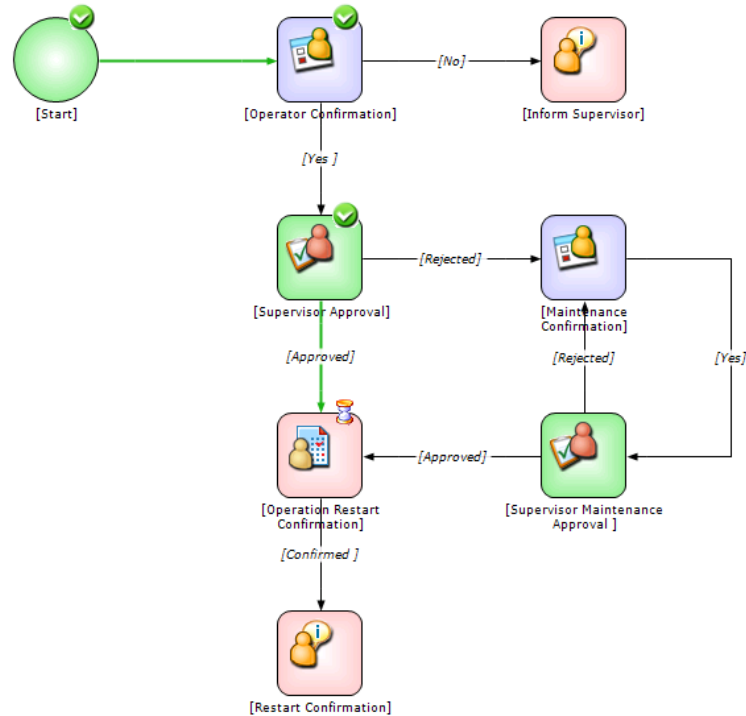
# The Workflow continues on...



# What the Supervisor see's...



# The Workflow continues on...



# The Workflow continues back to the Operator...

WorkItem Detail View

Manage Work item: (Operation Restart Confirmation): Take Ownership Go

**Restart Process**

The process is in control and has been reviewed by maintenance, please restart the filtration.

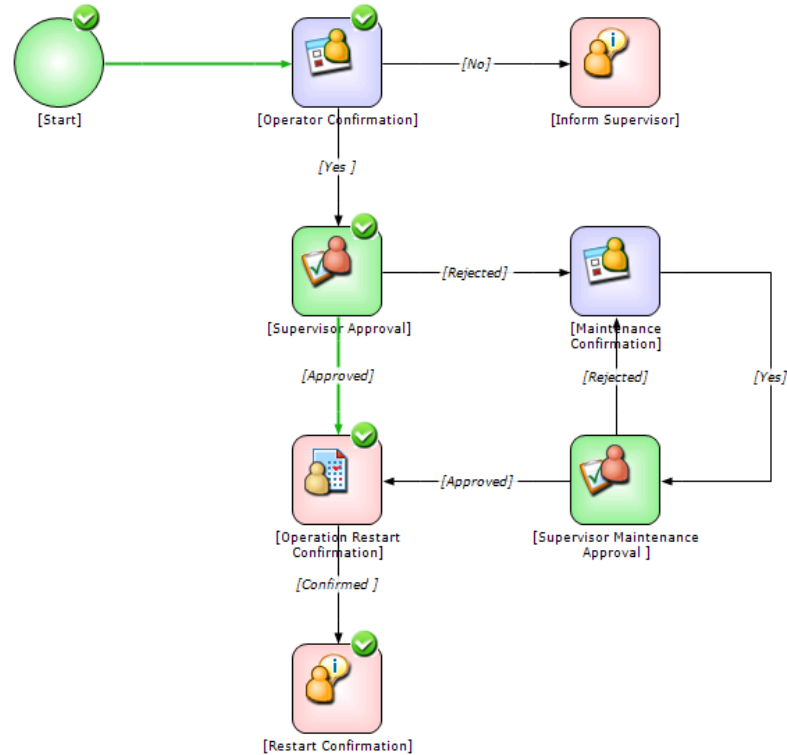
<b>Repository</b>	WonderWaterRepository
<b>Workflow</b>	TurbidityMonitorWorkflow
<b>Workflow Instance Id</b>	24 (Submitted By: Brian S. Martin)
<b>Execution Details Id</b>	92
<b>WorkItem Id</b>	0d934cb5-7983-4589-ad5a-6ce83a67d1e6
<b>Activity</b>	Operation Restart Confirmation
<b>Data Submitted</b>	<a href="#">Show Details</a>

**Comments**

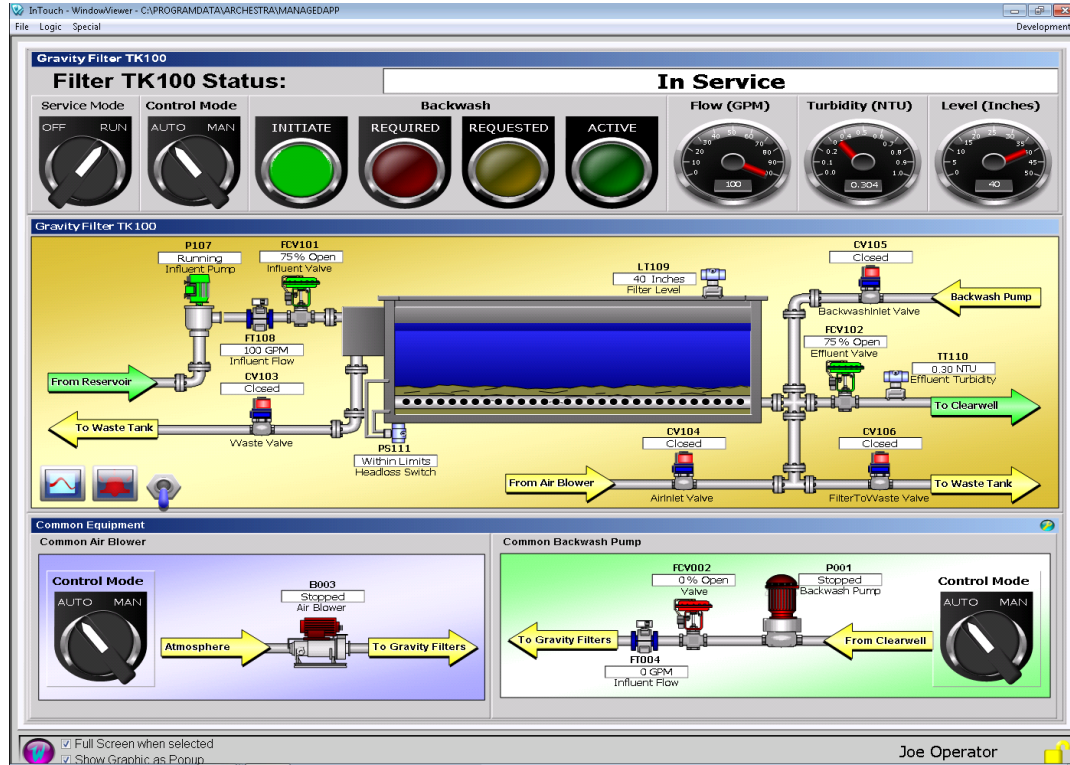
Confirmed

Joe Operator

# The Workflow completes on Operator confirm...



# The operation continues on... until next time...





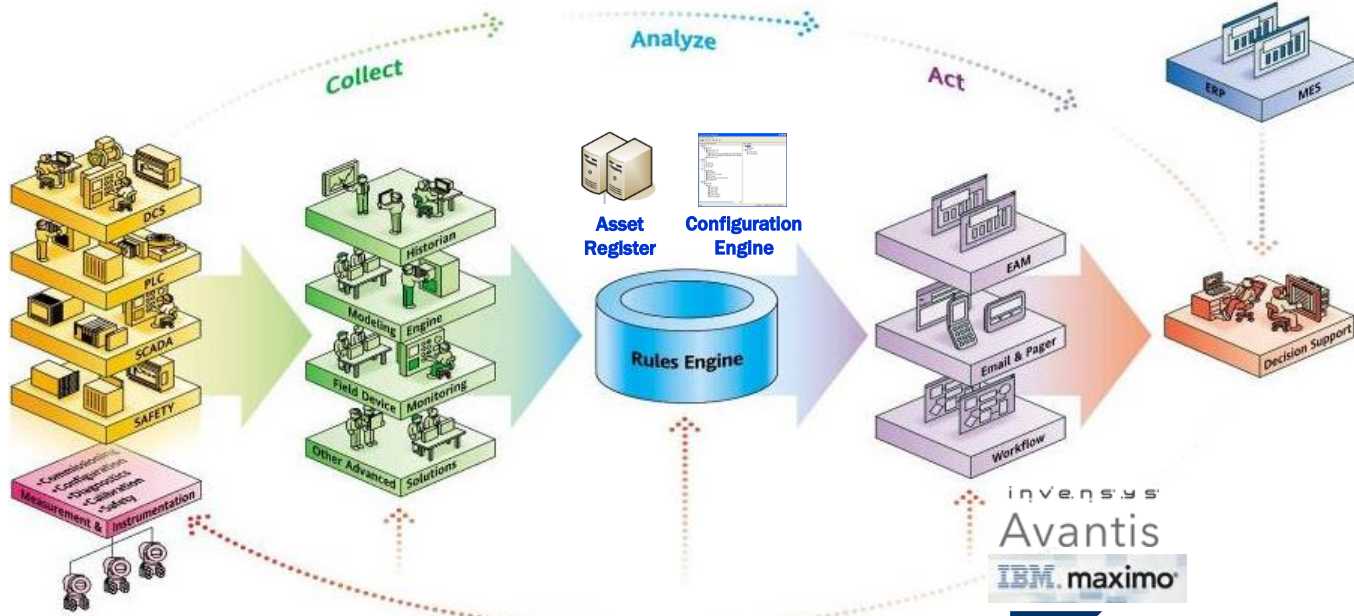
# Predictive Maintenance based on Conditions...

Data in context – your asset can tell you when things aren't good...

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**Schneider**  
Electric

# Condition Based Maintenance Approach



invenSys  
**Avantis**  
IBM maximo  
SAP

SimSci-Esscor.

Artisens  
invenSys  
Wonderware

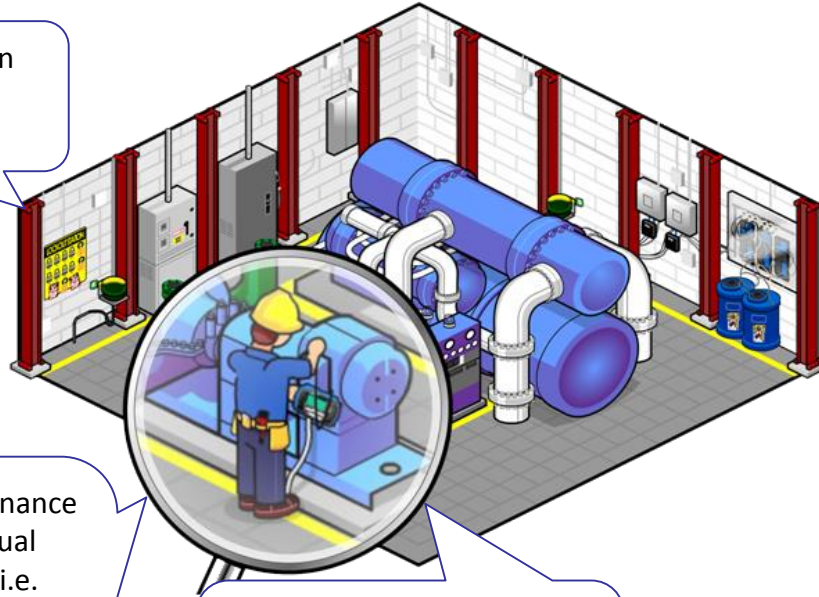
IA  
Intelligent  
Automation  
Series

SWANTech  
The Next Wave in Condition Monitoring

OSIsoft.

# Use Case – CBM Solution...

High asset availability in remote or unmanned locations is key.

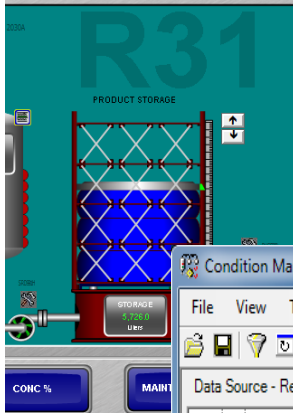


Calendar-based maintenance doesn't account for actual equipment utilization (i.e. run times)

- Only **15 - 20%** of equipment failures are **AGE RELATED**
- The other **80 - 85%** are totally **TIME-RANDOM** events

Operators must be able to generate work requests seamlessly when an equipment alert is observed

# Use Case – CBM Solution... Event from HMI



SCADA HMI will display condition state as of most recent update cycle (POLL) :

Operator situational awareness can be configure as a standard (example)

**YELLOW:** A reading of interest was found during most recent update cycle (i.e. some of the criteria for the generation rule was met) but an action was not triggered

**RED:** An action was triggered during most recent update cycle

A screenshot of the 'Condition Manager Configurator' software. The main window shows a configuration tree on the left and a 'Data Source - Real Time Points' section on the right. A 'ProdLevel' real-time point is selected, and its details are shown in a pop-up window. The 'Path' field in the pop-up is circled in red, showing the SQL path: [InSql][Analog][ProdLevel]. The 'Value' field shows 5363. The 'Update Time' is 5/31/2013 11:50:45 AM. The 'Description' is 'Product storage level' and the 'TagType' is 'Analog'.

Name	Value
Current Value	5363
Update Time	5/31/2013 11:50:45 AM
Quality	
QualityDetail	192
OPCQuality	192
wwRetainAllMode	DELTA
wwTimeDeadband	0
wwValueDeadband	0
wwTimeZone	Eastern Daylight Time
wwParameters	0
Description	Product storage level
TagType	Analog

# Use Case – CBM Solution... Action Triggered

Entity DVC5000 - Open Work

Component DVC5000  
FISHER FIELDVUE DVC5000 POSITIONER

Open work for this entity

Work Order	Task	Title	Task Status	Start no Earlier Than	Finish no Later Than	PM Job	PM Te
9900417	1	Valve Stiction - Valve Stiction	Not Started	5/31/2013	6/1/2013		

**Work Order Generated into EAM.....**

**Email sent to  
Maintenance Manager....**

Valve Stiction - Message (Plain Text)

From: condition.manager@invensys.local  
To: maintenance@invensys.local  
Cc:  
Subject: Valve Stiction

DVC5000\_Stiction - 5/31/2013 5:36:02 AM  
[AVW732VM\_ProdLevel][7909;OK;05:36:01;C]  
[AVW732VM\_OutputValve][1;OK;05:36:01;C] Work Order/Request [9900417] was create

# Use Case – Operational Work Advisory...

## Operator Visibility

- Operator
- Level
- Alert
- If
- Imp
- Le
- Al
- SC

**BOOSTER PUMP STATION**  
Sand Canyon Pump Station #3

Pump 001      Pump 002      85.7 GPM

On A R      On A R

**Work Details**

- 1. **Work Order**
  - Display Name: 4044
  - Work Order ID: 1
  - Enterprise ID: 1
  - Site ID: 2
  - Description: CBM Asset Health Alert Detected: Tag Name: Tag Val.
  - Title: CBM Event: Asset Health Alert for Vibrator Alert1
  - Created On: 5/15/2009 1:45:00 AM
  - Last Modified On: 5/15/2009 1:45:00 AM
  - Database ID: 0
  - Start Before:
  - Start After:
  - End Before:
  - End After:
- 2. **Issued By**
  - ID: 2
  - Enterprise ID: 1
  - Site ID: 2
  - Description:
  - Display Name: MtelCBM
- 3. **Issued By Type**
  - Display Name:
  - Type Code: 0
  - Description:
  - Database ID: 0
- 4. **Priority Level**
  - Display Name: 6
  - Type Code: 1
  - Description: 6
  - Database ID: 0
- 5. **Work Status**
  - Enterprise ID: 1

**Create Work Request**      PV1\_003

Work ID	Date	Status	Title
126132	4/15/2009	WAPPR	Replace pump
126131	4/15/2009	WAPPR	Pump malfunction
126129	4/15/2009	WAPPR	Replace pump
126130	4/15/2009	WAPPR	Quarterly inspection
126128	4/15/2009	WAPPR	Pump cavitation inspection

Double Click row for full Work Order Details

View most recent Work Orders for the Equipment directly from Maintenance System

## Final Thought...

We are the heavyweight in the industry, but it does us no good if we fight ourself...

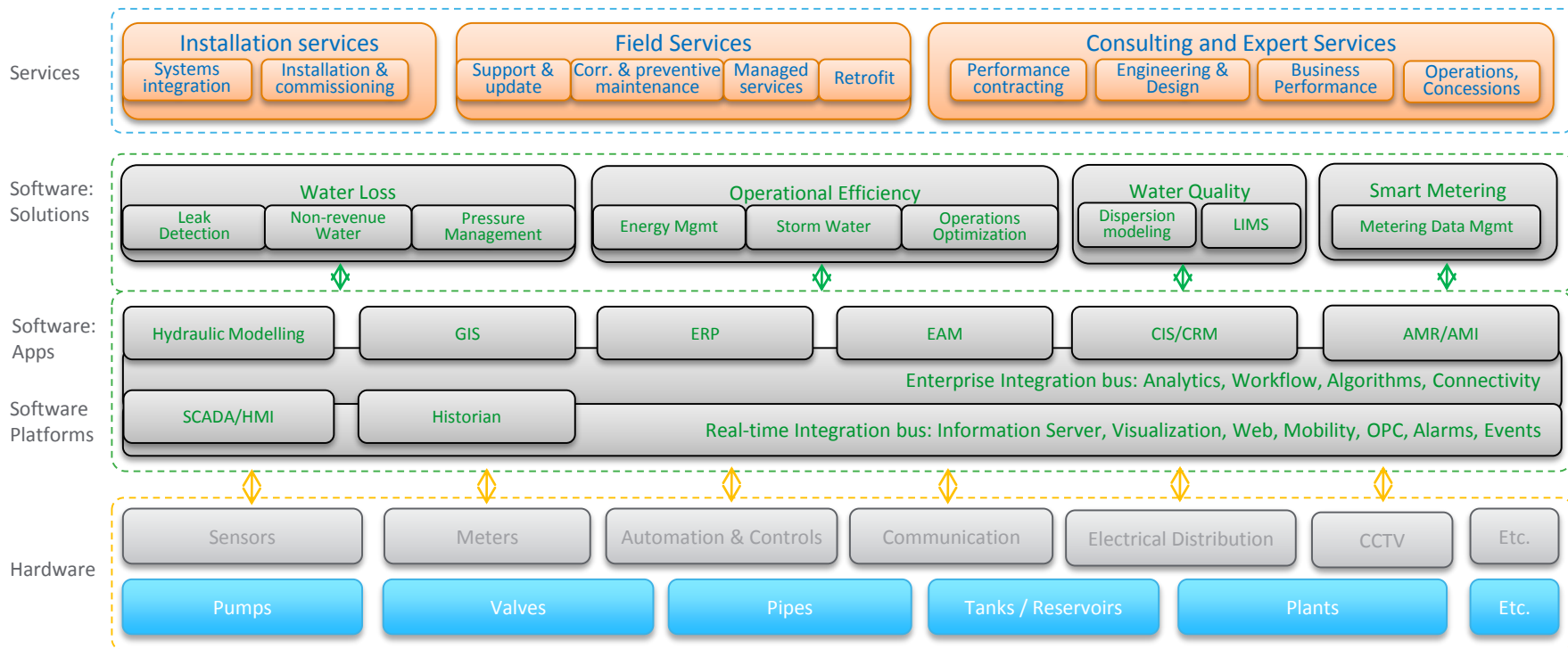
## *Making a better operator...*

- What keeps operators up at night..?
  - Regulatory concerns
    - Proper nutrient levels / residual chlorine / dissolved oxygen
  - Circumstances beyond their control
    - Climate / Storm runoff / crumbling infrastructure
  - And, when bad things happen
    - no time for the manual - TROUBLESHOOT

*Using Situational Awareness, embedded Workflows and predictive maintenance...*



# This is the space ~~with~~ **WHD** Deployment...



Thank you.