



# Enabling the Mobile Field Worker with Real-time Intelligence

*CH2M HILL's Automation Group*

CH2MHILL.      Michael Karl      2014

## Agenda

- Industry Challenges
- Mobile Intelligence Platform
  - Asset and Maintenance Management
  - Energy and Process Efficiency
  - Remote and Mobile Operations Applications
  - Business Dashboard and Reporting Applications
  - Surveillance and Security Applications
- Mobile Security



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**World class experience—local presence**

As a global leader in full-service consulting, design, design-build, operations, and program management services, we offer one of the most experienced water and wastewater engineering firms in the world. CH2M HILL has been providing SCADA services for over 30 years with more than 100 successful SCADA designs in the last decade.

 Automation Master Planning and Standards	 Information and Control Design	 Local and Wide Area Network Design	 PLC, HMI, and DCS Design/Programming	 Turnkey Control Systems
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Industry Challenges Lead to the development of a Smart Utility Software Suite & Mobile Platform

Top Challenges	Value Propositions
Economic Sustainability	Reduced Maintenance/ Energy Costs
Regulatory Compliance	Workforce Efficiency
Water Source	Predictive & Optimized Operations
Infrastructure	Business Information
Workforce	Workforce Training & Accountability
Security	Standards Operations & Maintenance

## Story Time - Operational Tool Changes

### • **Walter – “Operations by Alarms”**

- Operator, comes to work.
- Well 9 communication alarms all last night
- He's going to shut off his phone so he can get some sleep.
- 10am Alarm Win911... ? Can't hear intrusion at Well 9
- At 2pm, Walter runs into Bob, hey what's going on at Well 3? Nothing...
- ? Hmm who was there?
- “Operations by alarms”

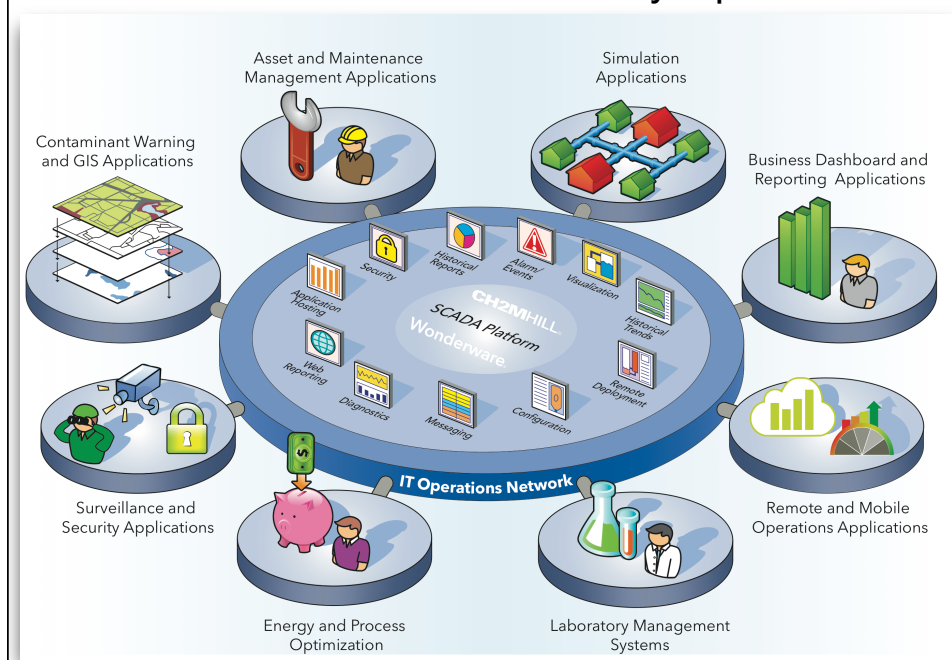
### Little Bit's Story

- Alarms are only triggered when they affect operations, communication alarm only when facility is needed
- When arrive at office the SCADA system suggests most efficient operations settings for the weather, water quality, storage requirements, etc.
- Mobile system provides overview of where colleagues are on daily work activities, health rating of the distribution system and a dashboard showing the efficiency of the system
- Chlorine delivery truck texts you that they will be onsite at 10:15am
- Alert “Well 7 Low Pressure”, SOP e-mailed

5

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## Pillars of Smart & Mobile Utility Operations



## CH2M HILL “Intelligent Water Solution”

- Spatially visualize the data from many sources
- Integration of data and systems to “Actionable Information”
- Creating opportunities for operational benefits
- Big data techniques are easily leveraged
- Intelligent Water Solutions save money and enhance overall operations
- Utilities no longer need to be “Data Rich and Information Poor”

### Intelligent Integration of Data

The diagram illustrates the data integration process. At the bottom, 'Source Data' includes Map Services GIS, Consumer Complaints, LIMS, OWM, SCADA, PMS, Smart Meters, and IT. These feed into a central 'Data Warehouse'. Above the warehouse is the 'Analytics' layer, and at the top is the 'Integration/Visualization' layer, which includes a calendar, a map, and several charts.

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## Mobile Real-Time Intelligence “Smart Grid for Water Utilities”

The screenshot shows a mobile application interface. The top part is a map of a water utility area with various data points and markers. Below the map is a table with columns for 'PresentTime', 'Address', and 'ID'. The table contains several rows of data. Below the table are two 3D plots labeled 'Spectral Absorption'. Each plot shows 'Absorption' on the vertical axis and 'Wavelength' on the horizontal axis. The plots show a peak in absorption at a specific wavelength, with the color scale ranging from 0 to 20.

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# Mobile Intelligence Platform

The Value of Now!

## Operators with iPads

FOCUS—INNOVATIVE AND ALTERNATIVE TECHNOLOGIES

### Deploying the iPad for Improved Operations Efficiency at King County Wastewater Treatment Plants

By Joe Karl, Bruce Kessler, Robert Waddell, and Dave Kelly

King County is implementing iPad tablets for improved operations at wastewater treatment plants as part of an overall strategy to control system vulnerabilities. This initiative will improve the tools that operators need as they conduct their increasingly complex tasks with fewer resources. The work includes integrating the Apple tablet device into the King County operations and maintenance (O&M) and IT asset architecture, and building the infrastructure to support mobile technology. The County is enhancing its wireless network and installing special technology like antenna systems to enable wireless connections to garbage and deep tunnels at the wastewater treatment plant. The implementation also includes multiple security enhancements to protect the cyber assets. The iPad initiative will enable King County to become an industry leader in operational efficiency, while making room for operations and maintenance staff to do their jobs more efficiently.

The primary benefit of the iPad is the flexibility it brings operators—they are no longer tied to the control room at all times. A fundamental aspect of operating a wastewater treatment facility is reacting to changes in the system. Some of these changes require the operator to make a physical modification or observation in the field. Previously, the operator would have had to wait for a second person to attend to the issue in the field, and receive it through radio communication with the control room. Under limited staffing conditions, this approach is problematic. With the technology, the operator can take the control room with him or her, make the field change and keep an eye on the control system at the same time. In emergencies, iPad also allows multiple users to access system information, which facilitates a quicker and more robust response to an emergency. The control room is no longer a bottleneck of information during a crisis situation.

The iPad also improves the quality of information that is available to staff in the field. Information is at the fingertips of each worker, no matter their role. For example, electricians and technicians can access drawings and reference material using the tablet, instead of carrying binders around with them. Maintenance staff can update work orders, add new work orders and enter better field notes from the tablet. Crews can observe and resolve issues through video feed from the iPad without everyone needing to physically gather in the field. The tablet technology multiplies the power of the County's existing work items.

A major concern of many people around mobile technology is ensuring data integrity and security of the network. King County's approach focuses on control of the tablets themselves, as well as enhancing network security. Tablet security.   
Gartner.com/2013/08/01

FALL 2012 | PITCH NEWSLETTER 31

**NEW APP**

### Empower your workforce with ProficySCADA for the iPad®

Gain visibility into your operations with the convenience and ease of use of our open, flexible and scalable HM/SCADA products on the iPad. As a leader in HM/SCADA software, GE's helping you improve productivity and efficiency by web enabling our HM/SCADA products using advanced server-based technologies to offer the ProficySCADA app. Empower your workforce today!

[→ Learn More](#)





## History Data Mining

**West Sound Daily System Report**

Start Time: 6/20/11 8:00  
Stop Time: 6/20/11 8:00

**Site 102 (West S.S.)**

- Blender 1 Runtime: 6 hr
- Blender 2 Runtime: 11 hr
- Blender 3 Runtime: 11 hr
- Blender 4 Runtime: 7 hr
- Blender 5 Runtime: 7 hr
- Blender Flow Avg: 783 gpm
- Blender 1 Flow Avg: 327 gpm
- Blender 2 Flow Avg: 785 gpm
- Blender Flow Total: 299,000 gal
- Blender 1 Flow Total: 147,000 gal
- Blender 2 Flow Total: 208,000 gal
- Blender 3 Flow Total: 7,551 gal

**Site 103 (West S.S.)**

- Blender 20 Runtime: 11 hr
- Blender 20 Flow Avg: 600 gpm
- Blender 20 Flow Total: 396,000 gal

**Site 107 (West S.S.)**

- Blender 18 Runtime: 11 hr
- Blender 18 Flow Avg: 608 gpm
- Blender 18 Flow Total: 399,000 gal

**Site 109 (West S.S.)**

- Blender Runtime: 23 hr
- Blender Flow Avg: 281 gpm
- Blender Flow Total: 153,000 gal

**Week 8 Data:**

Week	Mixing Machine	Rotating Machine
Week 5	~100	~100
Week 6	~100	~100
Week 7	~100	~100
Week 8	~100	~100
Week 9	~100	~100
Week 10	~100	~100
Week 11	~100	~100

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## Replacing Paper with Mobile Based Field Data Collection

**BUILDING 30: HEADWORKS**

DATE: 1-10-13

**COARSE BAR SCREEN**

TIME	2400	0400	0800	1200	1600	2000
RAW INF LEL	0	0	0	0	0	0
RAW INF H2S	3.6	3	0.3			

**SCREEN 1**

COARSE BAR SCREEN	ON/OFF	ON/OFF	ON/OFF	ON/OFF	ON/OFF
SCREEN 1	ON	ON	ON	ON/OFF	ON/OFF

**CONVEYOR**

CONVEYOR	CH/DOK	CH/DOK	CH/DOK	CH/DOK	CH/DOK	CH/DOK
CONVEYOR	CH/DOK	CH/DOK	CH/DOK	CH/DOK	CH/DOK	CH/DOK

**Hopper level**

Hopper level	FEET	FEET	FEET	FEET	FEET	FEET
Hopper level	2.07	2.0	2.5			

**SCREEN PUMP**

SCREEN PUMP	FEET	FEET	FEET	FEET	FEET
SCREEN PUMP	2.5	1.5	1.0	0.9	

**INLET LEVEL**

INLET LEVEL	FEET	FEET	FEET	FEET	FEET
INLET LEVEL	2.5	1.5	1.0	0.9	

**Emergency Overflow Ponds**

Overflow To	(Yes/No)	(Yes/No)	Empty	(Yes/No)	(Yes/No)	(Yes/No)
Pond	NO	NO	Empty			

**Return Valve**

Return Valve	OPEN/CLOSED	OPEN/CLOSED	OPEN/CLOSED	OPEN/CLOSED	OPEN/CLOSED
From #2 to #1	CLOSED	CLOSED	CLOSED		

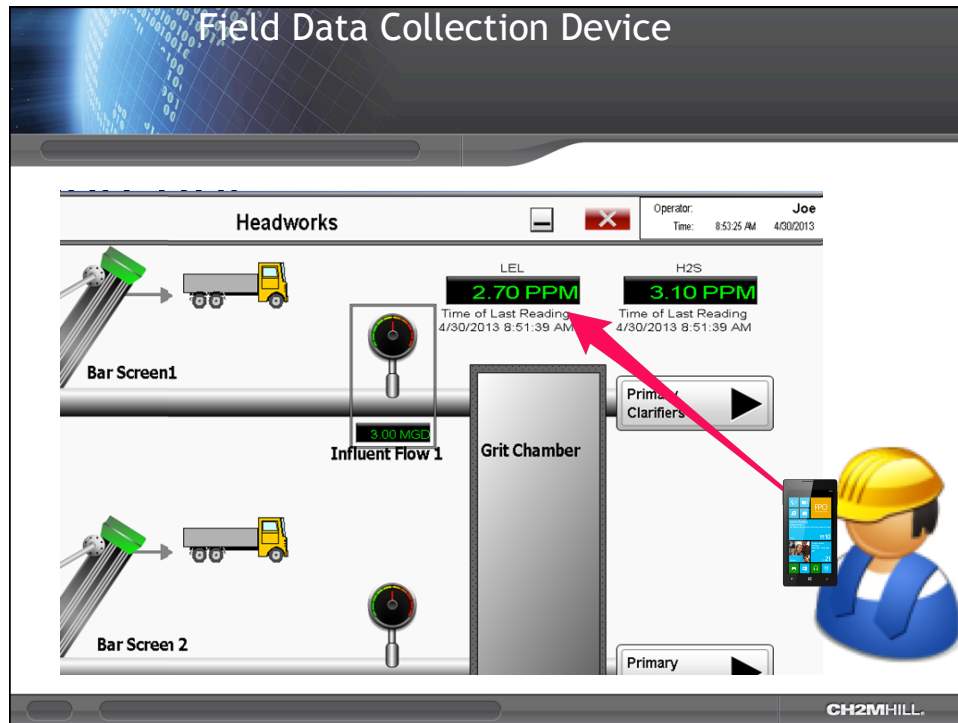
**RPM**

RPM	OFF	OFF	OFF
RPM	OFF	OFF	OFF

**MEDS Schedule (Area #7 Air Blowers & Grid Pumps)**

Time	2400	0400	0800	1200	1600	2000
Process air manifold	ON	ON	ON	ON	ON	ON
Air Blower #1 control	OFF	OFF	OFF	OFF	OFF	OFF
Air Blower #1 receiver	ON	ON	ON	ON	ON	ON
Air Blower #2 control	OFF	OFF	OFF	OFF	OFF	OFF
Air Blower #2 receiver	ON	ON	ON	ON	ON	ON
Air Blower #3 control	OFF	OFF	OFF	OFF	OFF	OFF
Air Blower #3 receiver	ON	ON	ON	ON	ON	ON
Air Blower #4 control	OFF	OFF	OFF	OFF	OFF	OFF
Air Blower #4 receiver	ON	ON	ON	ON	ON	ON

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### Common Use Mobile of Mobile Technologies?

SCADA

Engaging the public

- Communications
- Service requests
- Planning
- Mapping

Supporting workflows

- Field data collection
- Condition assessments
- Work order management
- Routing

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### eFIM - Sample System Overview



City of Redding California  
Clear Creek Wastewater Treatment Plant O & M Manual

Log Out

Search win Doc Text

- Home
- General Plant Description
- Process Control
- Raw Wastewater Pumping
- Headworks
- Primary Treatment**
- Bioreactors
- Secondary Clarification
- Effluent Filtration
- Chlorination
- Dechlorination
- Solids Processing
- Anaerobic Digestion
- Storage Ponds
- Outfall
- Plant Systems
- Laboratory
- Instrumentation and Controls
- Construction DWG
- Drawing Library
- Administration
- Search



### eFIM - Sample System Overview

Flows: Inluent 0.00 mgd, Effluent 0.00 mgd


Workstation: CONTROL1

48 Acknowledged Alarms In Summary

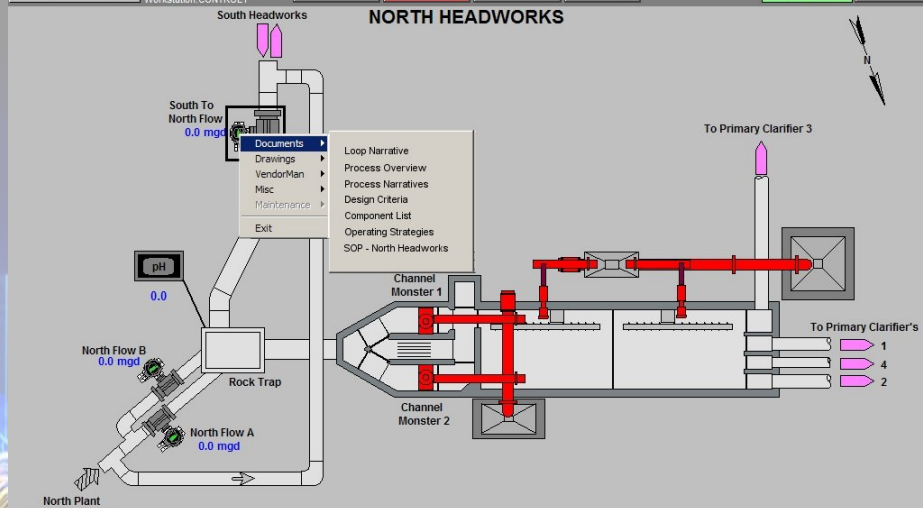
Help | Dialer On | **Dialer Off** | Print Screen | Summary

NULL

11:55:35




**NORTH HEADWORKS**



- Overview
- Solids
- Head Works
- Pri CL
- FEB
- Aeration
- SCL
- FIP
- Floc Basin
- Filter's Overview
- Filters
- BW/LW Pumps
- WW Tank
- Chemical
- Chlorine Channel
- Utility



### eFIM - Sample System Overview



**Home**

- Log Out
- General
- Influent PS
- Plant Drain PS
- Headworks
- Odor Control
- Aeration
- Secondary Clarification
- UltraViolet Disinfection
- Outfall
- Interchange Reactors
- Digestion
- Solids Handling
- Plant Systems
- IS Systems
- Laboratory
- Safety
- Pump Stations
- Constr Photos
- Drawing Library
- Administration
- Search

Documents (4) Drawings (31) Vendor Manuals (13) Miscellaneous (27)

- 1 - Overview - IPS
- 2 - UPCS - IPS
- 3 - Operating Modes - IPS
- 4 - Safety - IPS

**Influent PS**

**Influent Pump Station**

**Overview & Design Information**

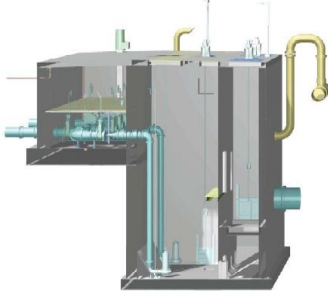
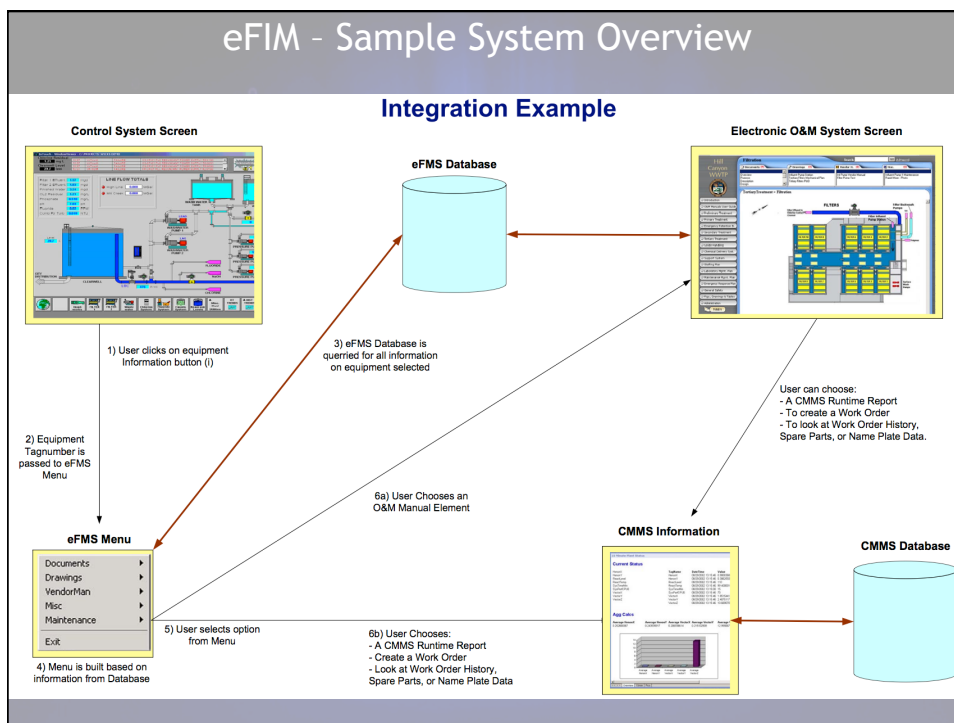



Figure 1: Influent Pump Station

**Purpose**  
The purpose of the influent pump station is to convey raw sewage from the



### High Performance Graphics

How well is this flow being controlled?

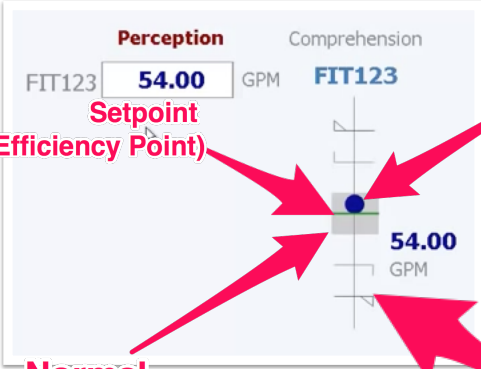


Perception  
FIT123 **54.00** GPM

Our current industry graphics aren't high value  
They limit us from gaining great value  
They don't enable real time learning

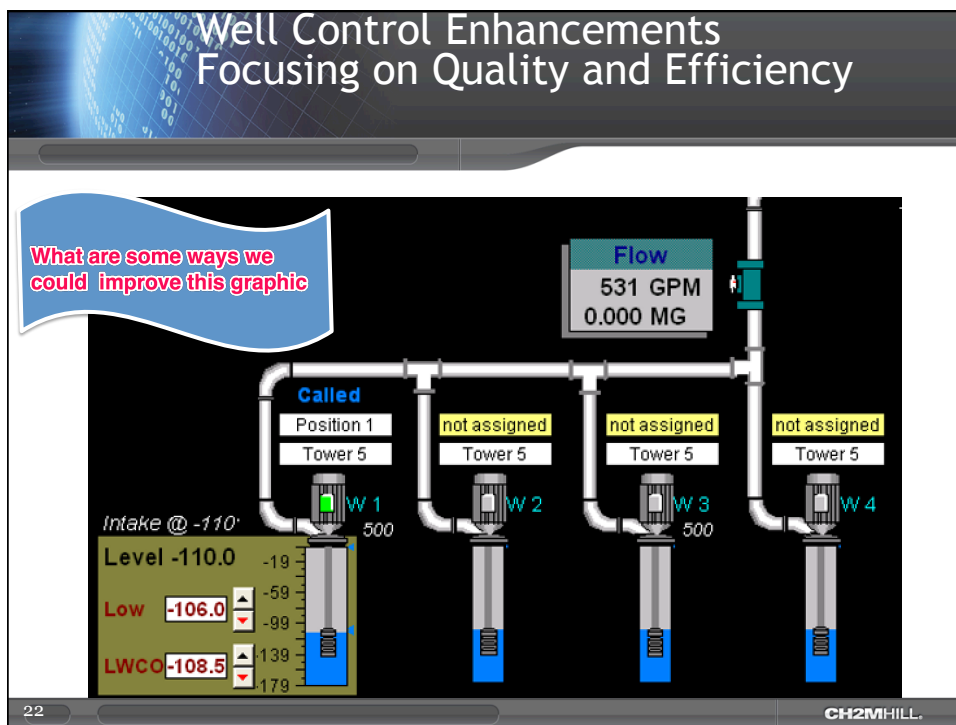
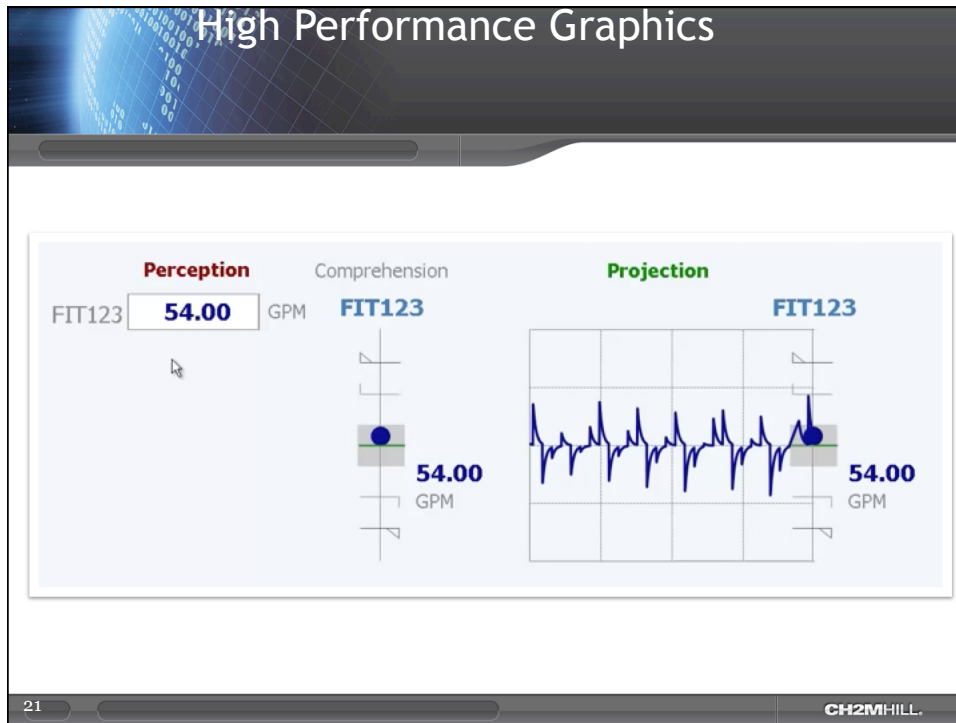
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### High Performance Graphics



Perception Comprehension  
FIT123 **54.00** GPM **FIT123**  
**Setpoint (Efficiency Point)**  
**Process Value**  
**Normal Range**  
**Alarm Limits**  
54.00 GPM

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## High Performance Graphics

Which visualization style best communicates overall control loop performance?

<p><b>Poor</b></p> <p>Temp 1 <input type="text" value="48.38"/> Deg F</p> <p>Temp 2 <input type="text" value="49.48"/> Deg F</p> <p>Temp 3 <input type="text" value="49.81"/> Deg F</p>	<p><b>Better</b></p> <p>T1 T2 T3</p>	<p><b>Best</b></p>
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Are all KPIs at expected values?  
How well is it being controlled?  
Does the operator need to intervene?

---

Which visualization style best communicates how well the Filter 100 process is performing?

<p><b>Poor</b></p> <p>Flow <input type="text" value="100.00"/> GPM</p> <p>Level <input type="text" value="40.00"/> In</p> <p>Turbidity <input type="text" value="0.18"/> NTU</p>	<p><b>Better</b></p> <p>Flow Level Turb</p>	<p><b>Best</b></p> <p>Flow</p>
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Are all KPIs at expected values?  
How well is it being controlled?  
Does the operator need to intervene?

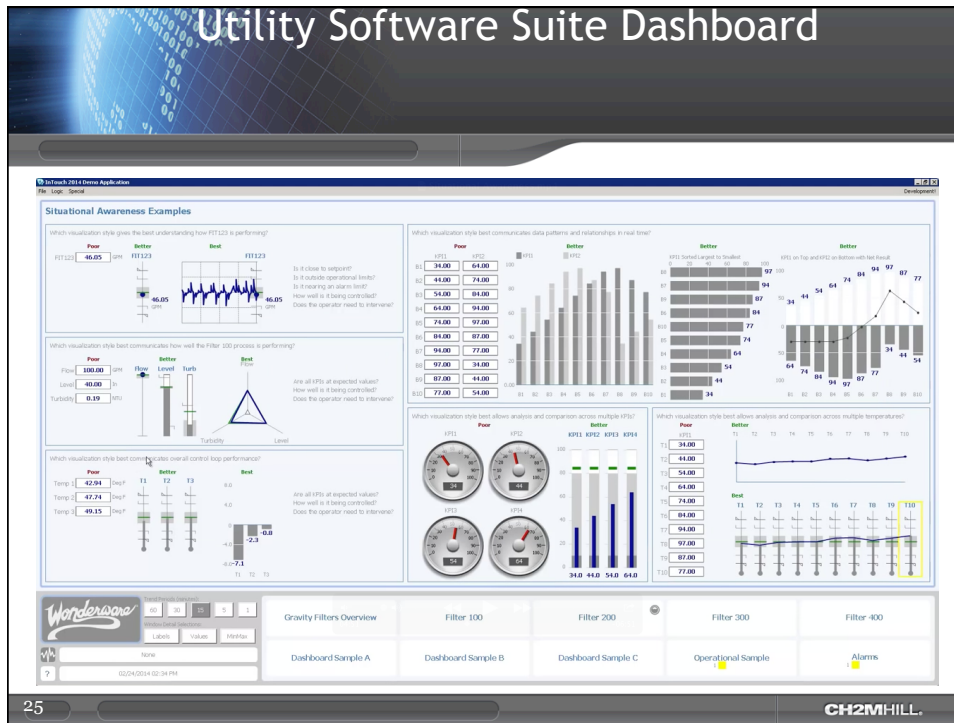
23
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## High Performance Graphics

Which visualization style best communicates data patterns and relationships in real time?

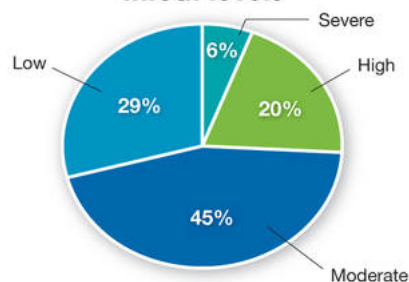
<p><b>Poor</b></p> <table border="1" style="font-size: small;"> <thead> <tr><th></th><th>KPI1</th><th>KPI2</th></tr> </thead> <tbody> <tr><td>B1</td><td>29.00</td><td>0.00</td></tr> <tr><td>B2</td><td>19.00</td><td>10.00</td></tr> <tr><td>B3</td><td>9.00</td><td>20.00</td></tr> <tr><td>B4</td><td>0.00</td><td>30.00</td></tr> <tr><td>B5</td><td>10.00</td><td>40.00</td></tr> <tr><td>B6</td><td>20.00</td><td>50.00</td></tr> <tr><td>B7</td><td>30.00</td><td>60.00</td></tr> <tr><td>B8</td><td>40.00</td><td>29.00</td></tr> <tr><td>B9</td><td>50.00</td><td>19.00</td></tr> <tr><td>B10</td><td>60.00</td><td>9.00</td></tr> </tbody> </table>		KPI1	KPI2	B1	29.00	0.00	B2	19.00	10.00	B3	9.00	20.00	B4	0.00	30.00	B5	10.00	40.00	B6	20.00	50.00	B7	30.00	60.00	B8	40.00	29.00	B9	50.00	19.00	B10	60.00	9.00	<p><b>Better</b></p>	<p><b>Better</b></p> <p>KPI1 Sorted Largest to Smallest</p>
	KPI1	KPI2																																	
B1	29.00	0.00																																	
B2	19.00	10.00																																	
B3	9.00	20.00																																	
B4	0.00	30.00																																	
B5	10.00	40.00																																	
B6	20.00	50.00																																	
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B8	40.00	29.00																																	
B9	50.00	19.00																																	
B10	60.00	9.00																																	
		<p><b>Better</b></p> <p>KPI1 on Top and KPI2 on Bottom with Net Result</p>																																	

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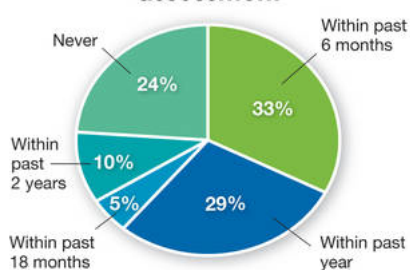


## February 2014, Control Engineering surveyed members

### Control system cyber security threat levels



### Most recent vulnerability assessment



Of the respondents who indicated that their organization has never performed a vulnerability assessment, **33% have been aware of between 1 and 5 malicious cyber incidents in their control system** networks and/or control system cyber assets in the last 24 months. One-third of these incidents were declared as accidental infections, **while 20% were targeted in nature**, and 47% were a combination of targeted and accidental.

27

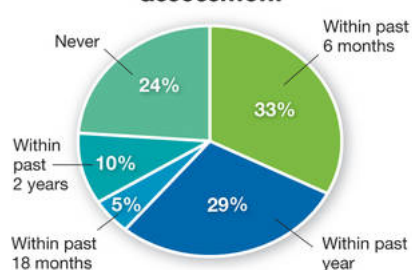
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### Most recent vulnerability assessment




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## Surveillance and Security Applications

- Network segmentation
- Intrusion Detection Software
- Single Sign-On software
- Remote SCADA Connections
- Supporting Mobile Devices
- Physical Security Integration



**Regulatory Update - February 28, 2014**  
*J. Ann Edwards, J.C. EPA Director of Federal Relations*


At the start of any calendar year (even though it's the end of February), it's always good to take a look ahead and see what's coming in EPA's regulatory agenda. EPA's Office of Compliance and Drinking Water (COWD) continues to face a tight regulatory agenda, however, several major regulatory actions have been delayed or canceled. These delays are a result of the sequestration budget cuts in early 2013, as well as a decrease in the overall EPA budget for the same number of employees. However, it is good that the regulatory process is still in full swing. Year-end COWD priorities and deadlines, and the status of the regulatory development process has slowed down, the team will have more time and avoid several drinking water regulations.

These delays have resulted in some regulatory actions that were anticipated in early 2013 to have been completed by the end of 2013 to have slipped to 2014; others have slipped to 2015, or possibly later. The table below summarizes what is expected to be released in 2014 and what is anticipated to slip until 2015 (or possibly later).

Expected in 2014	Delayed to 2015 (or later)
Final Third Regulatory Determination	Proposed Lead and Copper Rule Long Term Revisions (LCR-LTR)
Final Fourth Contaminant Candidate List (CCL4)	Proposed Pathogens Rule
Final Best Management Practices (BMP) for drinking water (BMPs) and (Interim) (BMPs)	Proposed Contaminant Viable Organic Compound (CVO) Rule
Cybersecurity Framework and cybersecurity	Lead-IT evaluation

While there is some ongoing uncertainty with regulatory schedules and there will be lots of regulatory action "behind the scenes" what the drinking water community will see published in the Federal Register in 2014 will be based on new "water" regulatory actions resulting from the five year cycle in the SDWA regulatory process for identifying new contaminants for potential regulation. The new regulatory actions anticipated from EPA in 2014 are the drinking water "regulatory agenda" with the 2014 Contaminant Candidate List (CCL4) and a draft Fourth Contaminant Candidate List (CCL4).

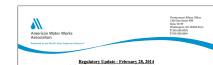
The Third Regulatory Determination will be published in first half of 2014, but it's completely clear what will be included in this action. Preliminary priority determinations



Surveillance and Security Applications  
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## AWWA Regulatory Update - February 28, 2014

### *Cybersecurity framework and cybersecurity and IST evaluations*



**Regulatory Update - February 28, 2014**  
*J. Ann Edwards, J.C. EPA Director of Federal Relations*

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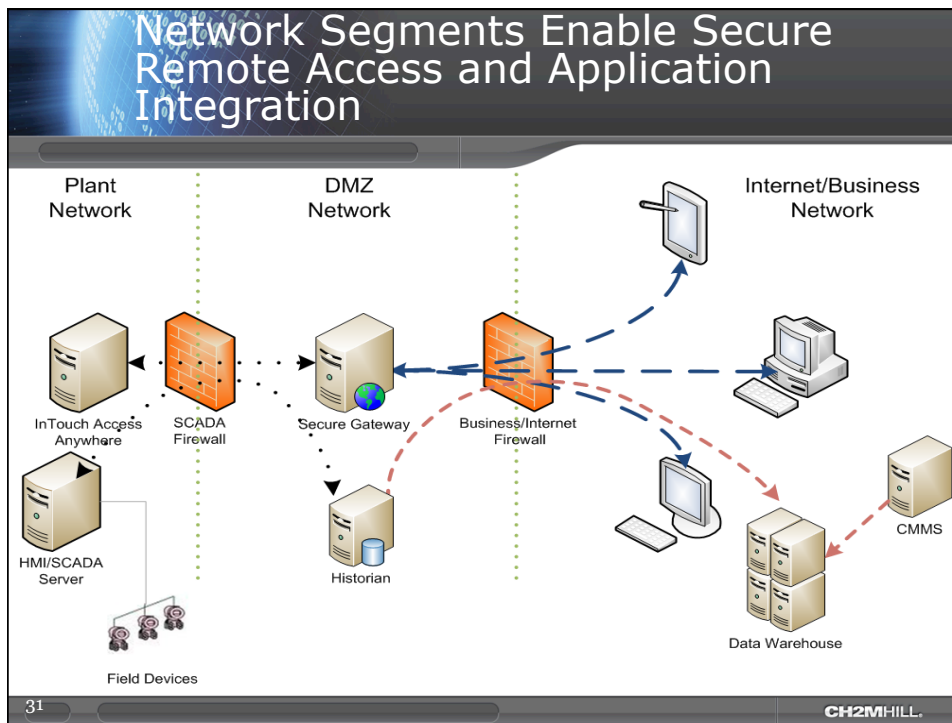
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The National Institute of Standards and Technology (NIST) released its **Cybersecurity Framework Version 1.0** on February 12, 2014. It should be noted that this document is only a framework and not a regulation. AWWA has developed guidance and a tool for water systems that matches up with this framework. In my judgment, it's not likely that any additional regulations will result from this framework. However, as part of Executive Order 13606 that required this framework to be developed, EPA has to make an evaluation as to whether any additional authority and/or regulations to address cybersecurity in the water sector are needed. Additionally, cybersecurity has received some legislation attention given some of the recent data breaches and it's always challenging to predict what Congress might do.

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## How do I prepare "Mobile Workforce"?

- Start with early wins! (Remote SCADA/ paper replacement)
- Don't start without a vision/plan (Corel, Lotus, MS, Word Perfect)
- Ensure IT infrastructure is setup for mobile security
- Implement policies and best practices
- Document/Celebrate efficiencies and savings
- Share success stories with management and the community

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