Integrating Data Management with Powerful Digital Tools

Western Chapter – Spring Wastewater Conference – May 17, 2016

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Integrating Data Management with Powerful Digital Tools
Agenda

- **Utility problems with tighter regulations, aging workforce and budget pressures**
  - Passing along institutional knowledge
  - Integration of data silos
- **Re-purposing O&M Manuals**
  - O&M Resource Documents before digital technology
  - Electronic O&M – Digitizing and Integrating O&M Information
  - Easy Access When You Need It
- **Plant "walk throughs"**
  - Collect More Information in Less Time
    - Eliminate multiple data entry points and associated errors
    - Eliminate pen and paper data gathering
    - Eliminate inconsistent sample locations
    - Eliminate paper chain of custody forms
  - Automate "Chain of Custody" to "Maintenance Work Orders"
- **Plant Operation**
  - Decision Making with More Information from your custom Dashboard
  - Integrate Lab, SCADA, Operations Field Data using Hach WIMS
- **Digitizing and Integrating Data Requires More In House Training to fully "Integrate Staff"**
  - Performance Based Training to Maximize Digital Tools

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"Data Silos" must be integrated

- Static information sources such as O&M Manuals have to be retooled digitally and integrated into the plant WIMS.

- SCADA will merge "online – real time" information directly into WIMS

- Field data will also integrate and eliminate "heads down" data management recording field data. No data transfer by hand.

- LIMS (laboratory information management) must integrate for rapid access by remote facilities.

- CMMS will be integrated with operations field work, SCADA and provide feedback to staff.

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Data Integration
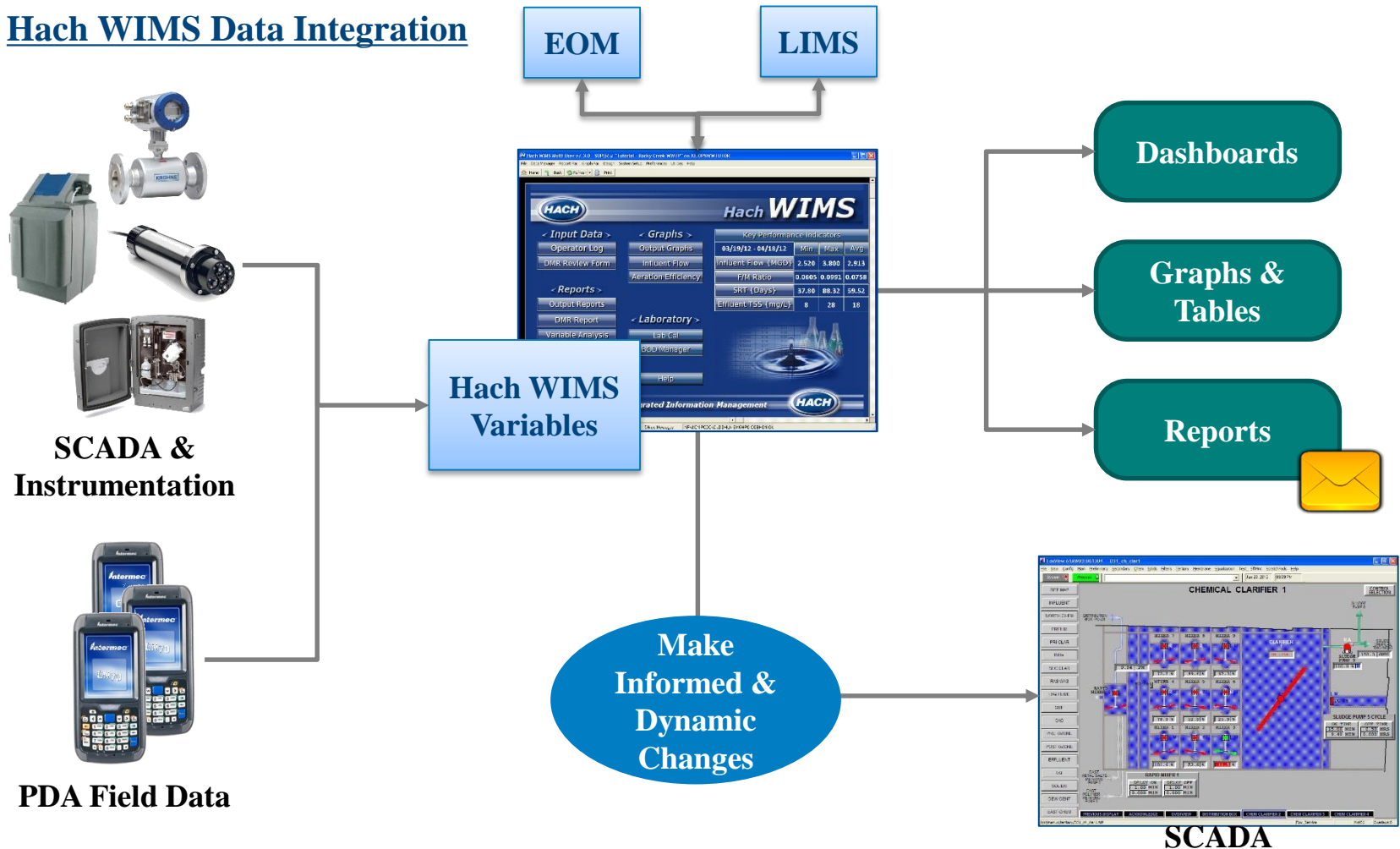# Littleton/Englewood, Colorado

Examples from L/E WWTP staff where last 15+ years of implementing knowledge management practices have produced efficient data integration practices.

Data Integration

- Decision Making with More Access to Information

Hach WIMS Data Integration

SCADA & Instrumentation

PDA Field Data

EOM

LIMS

Hach WIMS Variables

Dashboards

Graphs & Tables

Reports

Make Informed & Dynamic Changes

SCADA

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Data Integration

- **Problem:**
  - Utilities are faced with increasingly stringent regulatory responsibility, advancing treatment technology, plant staff needs to be well trained and continuously up-to-date on treatment and technology that supports successful operation and meets the regulatory requirements.
  - Major construction project typically addresses infrastructure improvements, capacity expansion needs, and adds new processes. Staff will have to be prepared to operate a new plant with new equipment. This requires development of all new Standard Operating Procedures (SOPs).
  - While this dynamic is going on, the aging workforce is becoming eligible for retirement. There is a significant knowledge loss, particularly in the Operations Division.

Data Integration

- Typically the knowledge base is provided with in-house notebooks and manuals for certain procedures and equipment. In many cases, these documents are outdated and no longer reflect current operations' methods, or cannot be quickly located.

- Inexperienced operators must often rely upon the help of veteran staff to recognize problems, troubleshoot, or to make appropriate operational decisions.
  - Knowledge must be captured and stored in either an electronic or documented format, and be managed as a living, evolving process.
  - Staff must be able to easily access information when necessary.
  - All mission critical elements of the operations process must be captured.
  - The plant must have a person(s) dedicated to and responsible for the maintenance and administration of the knowledge management program.
  - Information systems must be in place to support the knowledge management program.
  - A dedicated schedule must be followed to ensure knowledge capture will occur before veteran staff retires.

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# Electronic Operations and Maintenance Information Easy Access When You Need It

Data Integration
Organize you knowledge base.

- The most important part of making a successful EOM is the process put in place for managing documents and knowledge.

- Manula or Doc-To-Help, are examples of software tools for creating and maintaining interactive manuals of any kind. These tools and will enable access on any device for an existing knowledge based that may be Word documents.

- Schedule a work order to update the SOP's is what makes their SOP maintains value – this way the SOP's that folks use the most are always kept up to date.

- O&M, without the pain of trying to find relevant information. Collect and organize O&M information as an asset is being built, to capture designs and data. Have this prepared with the existing plant.

- Examples of document management tools:
    - http://www.manula.com/#create
    - http://www.doctohelp.com/overview/
    - http://www.aconex.com/operation-and-maintenance-manual
    - http://www.helpandmanual.com/products_hm_overview.html

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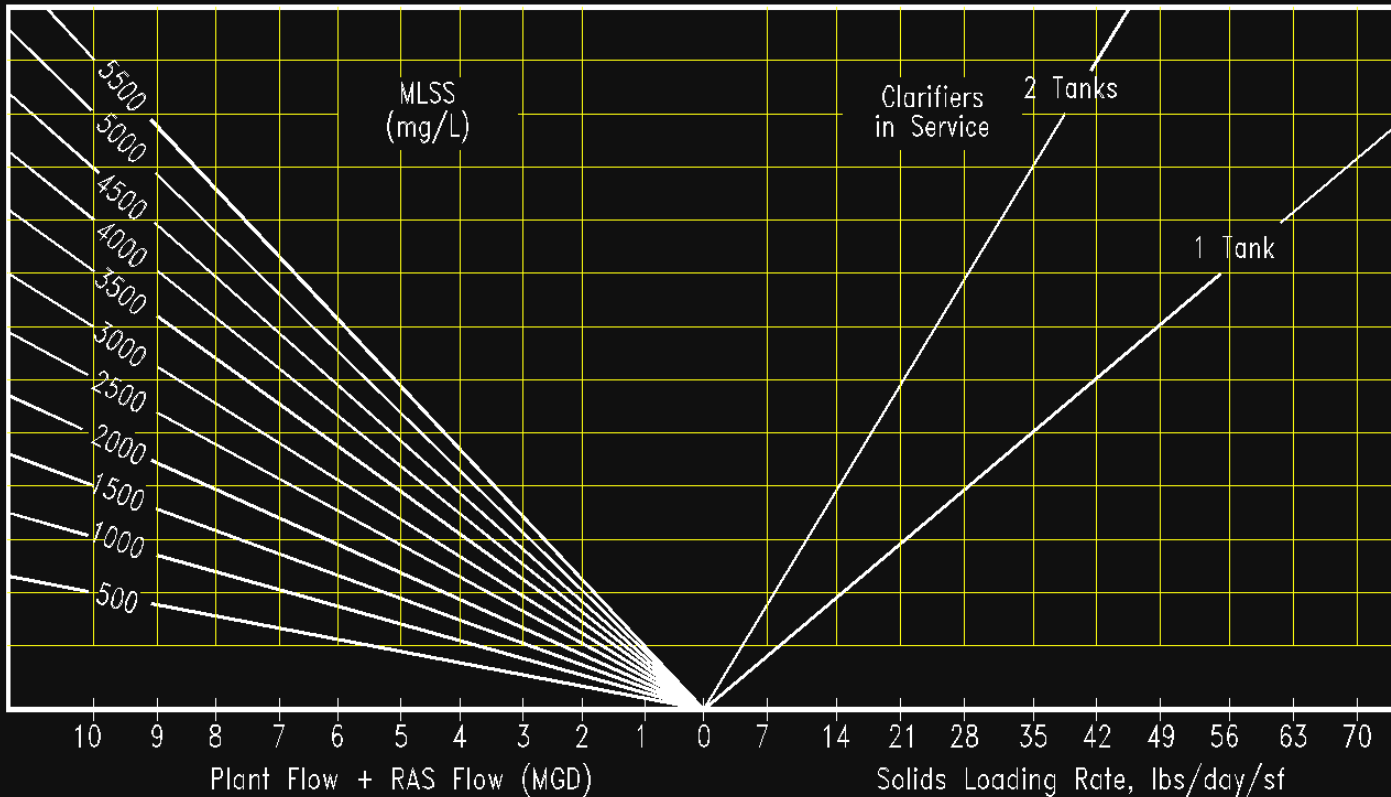# Examples of Pocket References for Field Support prior to Digital Devices

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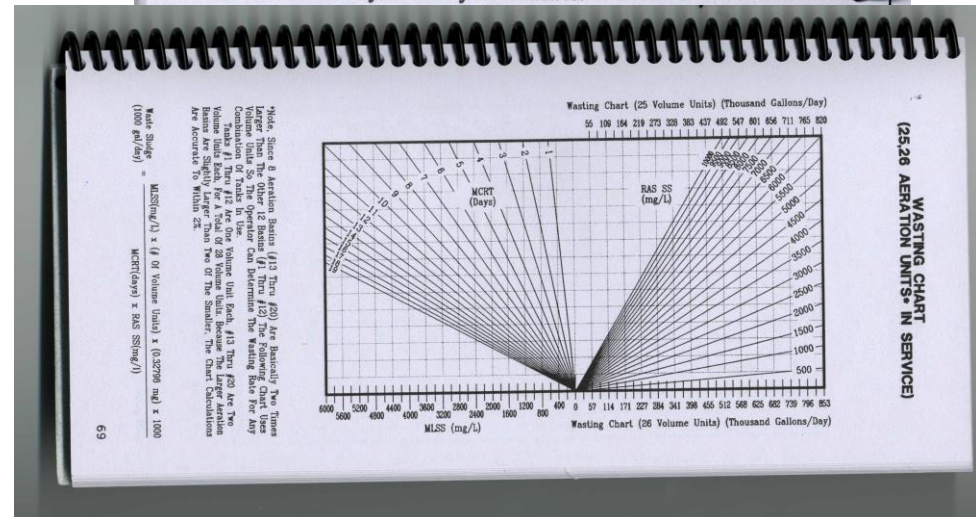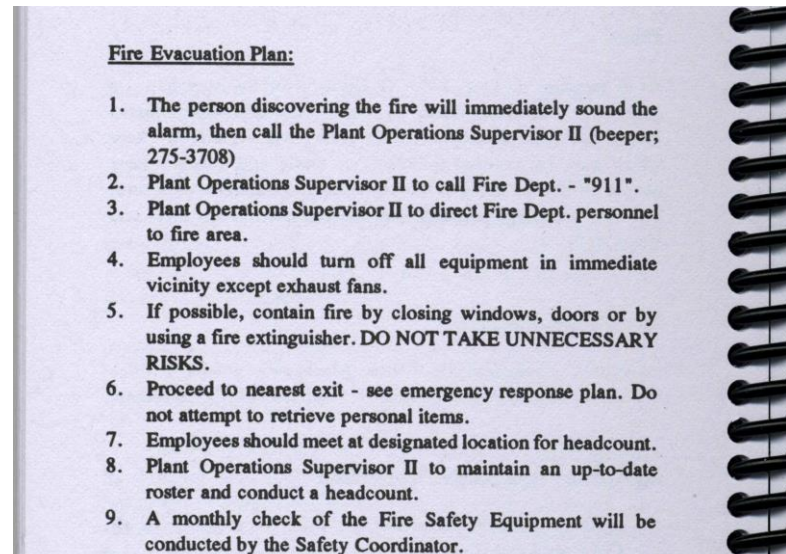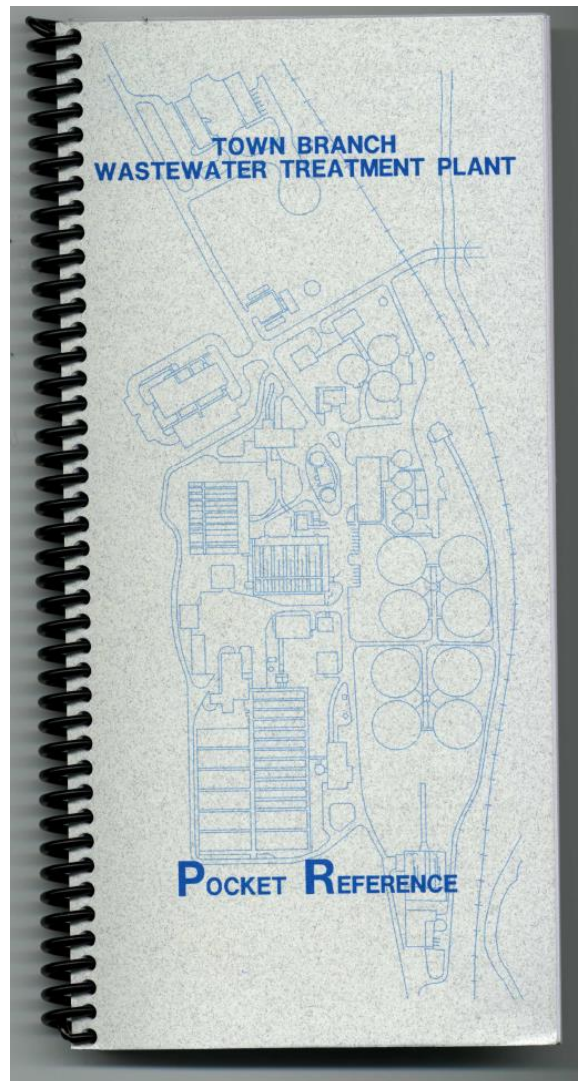
Pocket References for Field Support Information in the Field: 4"x 8"

- To be a quick reference, the information must be accessible
  - The small size made this booklet and its information readily accessible
- The goal was to find the booklets on a lunch room table or the dash of a City truck
  - The pocket reference was small enough to be handy while designed to be a reference of key information
- Multiple Nomographs or Graphical Solutions were provided for each process
  - Design data another "operator" tool
- Digital storage can provide much more than originally developed…real time trends can be provided with references to specific training/SOPs for various unit processes

Graphical Solutions – Solids Loading Rate

SOLIDS LOADING RATE CHART

MLSS (mg/L): 5500, 5000, 4500, 4000, 3500, 3000, 2500, 2000, 1500, 1000, 500

Clarifiers in Service: 2 Tanks, 1 Tank

Plant Flow + RAS Flow (MGD): 10 9 8 7 6 5 4 3 2 1 0 7 14 21 28 35 42 49 56 63 70

Solids Loading Rate, lbs/day/sf

$$\text{Solids Loading Rate, lbs/day/sf} = \frac{(\text{Flow*, MGD})(\text{MLSS, mg/L})(8.34 \text{ lbs/gal})}{\text{Clarifier Surface Area, sf}}$$

* Includes RAS Flow

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Graphical Solutions – Sludge Wasting

WASTING CHART
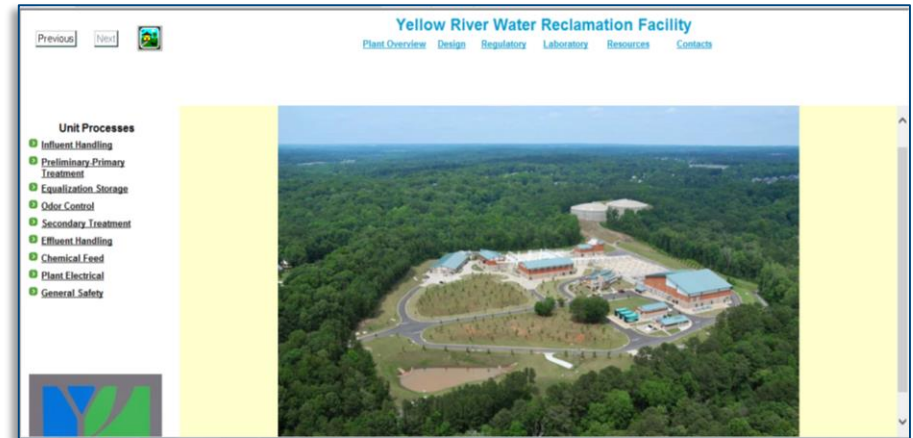**(2 VLR's in Service)**
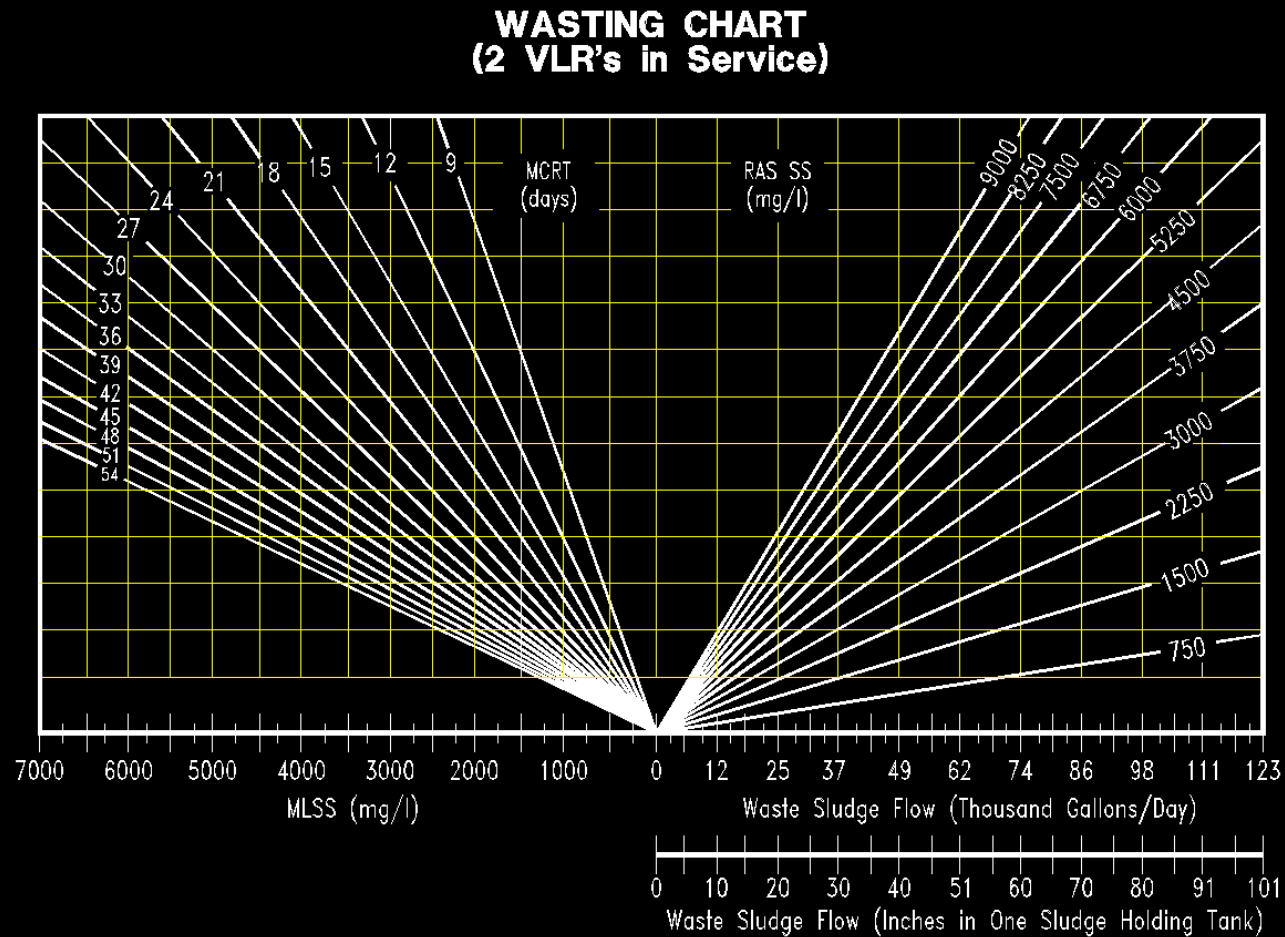
$$\text{Waste Sludge, (1000 gal/day)} = \frac{\text{MLSS, pounds}}{(\text{MCRT, days})\ (\text{RAS}_{ss}, \text{mg/L})\ (8.34\ \text{lbs/gal})} \times 1000$$

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Data Integration

EOM Information – Easy Access When You Need It

- **Integrated EOM**

- Secure intranet deployment – no access outside your organization

- Updated safety information, SOP's and other resources to complement recent and ongoing changes

- Multiple levels of user access to EOM resources

- Microsoft Word templates for SOP's and other EOM documents

- Reoccurring Work Orders for keeping core SOP's and other EOM documents up to date

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Data Integration
EOM Information – Easy Access When You Need It

Integrate EOM with Hach WIMS

- Link to safety information, SOP's and other EOM resources from Hach WIMS dashboard buttons

- Reference different EOM resources on each dashboard as needed

EOM Document and Resources

Record Drawings

Design Information

Reports

Equipment

Vendor O&Ms

Permits

Process Control

SOPs

Safety

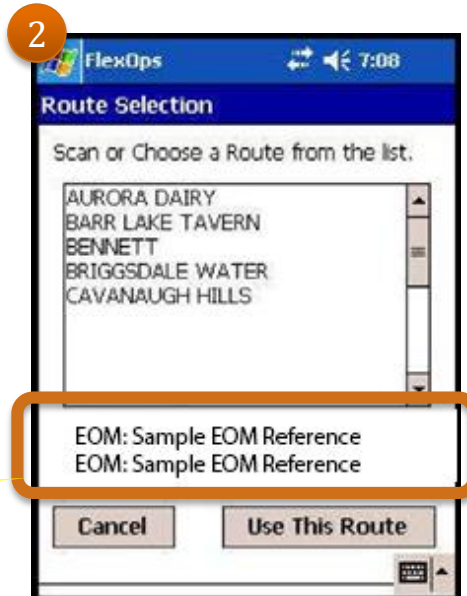**Plant Calendar**

Training records

Data Integration

EOM Information – Easy Access When You Need It

1

Integrate EOM with PDA's

- Relate tasks on PDA to safety information, SOP's and other resources in EOM

- Multiple EOM links per task as required

- PDA screens too small for most EOM resources

2

EOM References shown on PDA screen

3

Field Workstations

- Automatically pull up the resources needed by entering the EOM references shown on PDA

- Multiple workstations in locations that are convenient for field Operators to access

- Used by field Operators to securely access EOM

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EOM Information – Easy Access When You Need It

- **Key Benefits**
    - Manage EOM information in one place and access it from multiple locations
    - Update EOM information to reflect most recent changes (e.g. SCADA upgrades)
    - Make it easier for Operator to find safety information, SOP's and other EOM resources
    - Make it easy to access SOP's and other EOM information from Hach WIMS
    - Ultimately spend less time looking for EOM information and more time operating
    - Use existing CMMS tools to notify staff when reviews and updates are needed for SOP's and other EOM resources

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Plant "walk throughs" –

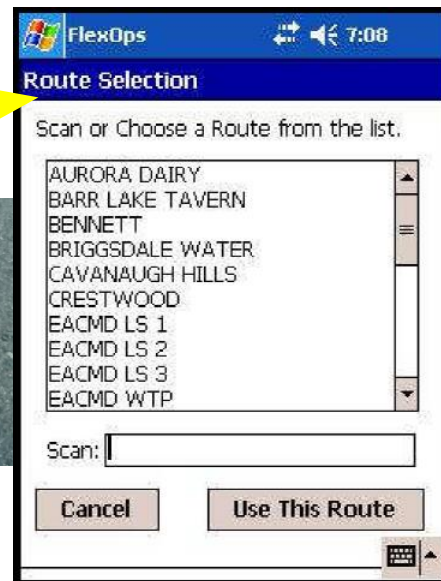**Collect More Information in Less Time**

Data Integration

Plant Walk-throughs – Collect More Information in Less Time

PDA Handhelds - Rugged, water-resistant, fit in pocket or belt clip

- Many sizes and models with different screens, keyboards, and features

- Intrinsically safe devices available for some models

- Higher cost devices pack more functionality into smaller and lighter devices

- Implement a single PDA hardware and deployment solution (hardware, software, support)

Screen sizes about 2" x 3"

FlexOps 7:08

Route Selection

Scan or Choose a Route from the list.

AURORA DAIRY
BARR LAKE TAVERN
BENNETT
BRIGGSDALE WATER
CAVANAUGH HILLS
CRESTWOOD
EACMD LS 1
EACMD LS 2
EACMD LS 3
EACMD WTP

Scan:

Cancel   Use This Route

Intrinsically Safe Device

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Plant Walk-throughs – Collect More Information in Less Time

Barcode Tags

- Self-perform using low cost barcode creation software and printers

- Create barcodes on any type of label material

- Automate coordination of barcodes with other systems
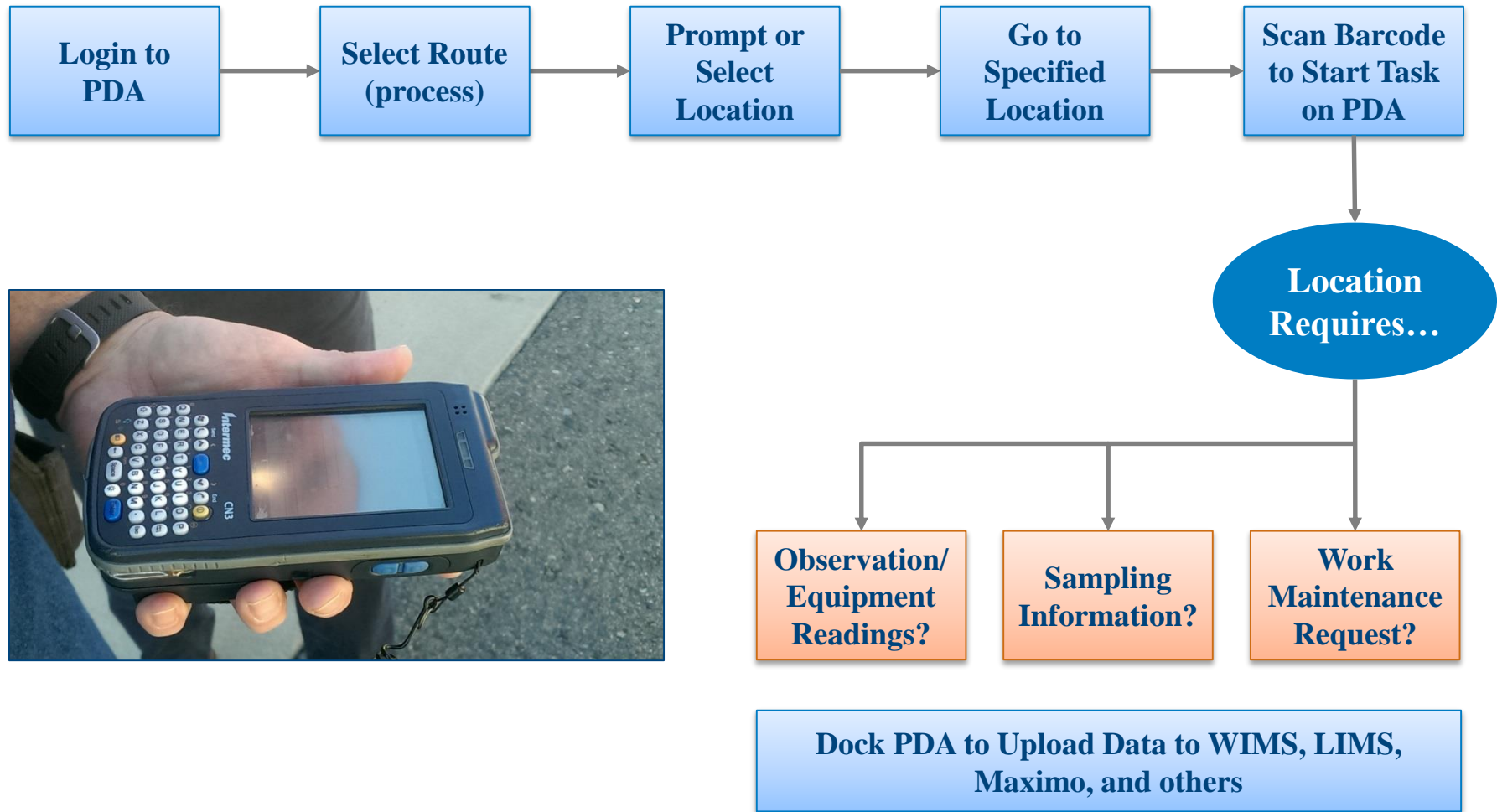
Operations Barcode Tag (Yellow Tag)

Maintenance Barcode Tag (Orange Tag)

Data Integration
Plant Walk-throughs – Collect More Information in Less Time

Login to PDA → **Select Route (process)** → **Prompt or Select Location** → **Go to Specified Location** → **Scan Barcode to Start Task on PDA** → **Location Requires…**

Location Requires… branches to:
- **Observation/ Equipment Readings?**
- **Sampling Information?**
- **Work Maintenance Request?**

Dock PDA to Upload Data to WIMS, LIMS, Maximo, and others

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Data Integration

Plant Walk-throughs – Collect More Information in Less Time

Sampling Information (With or Without Lab Bottles)

| Sampling Information | → | Scan Barcode to Start Sample on PDA | → | Scan Bottles | → | Follow PDA Screens to Complete Sample | → | Data Is Validated and Stored Locally on PDA |

Includes:
Sample Data
COC Data
Time Stamps

Yellow Barcode Tags

Bottle Label Barcodes from LIMS
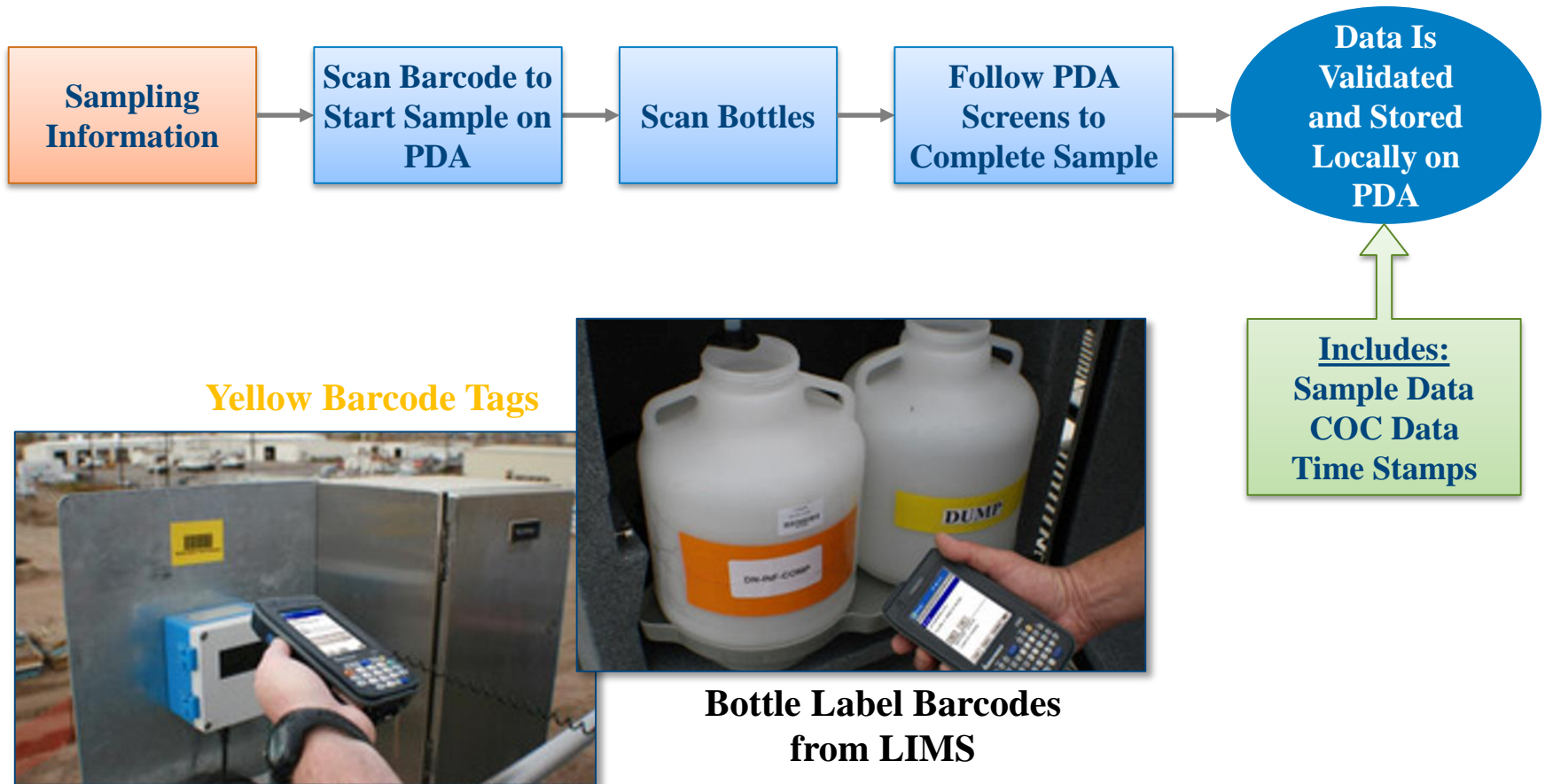
Data Integration

Plant Walk-throughs – Collect More Information in Less Time

Work Maintenance Request

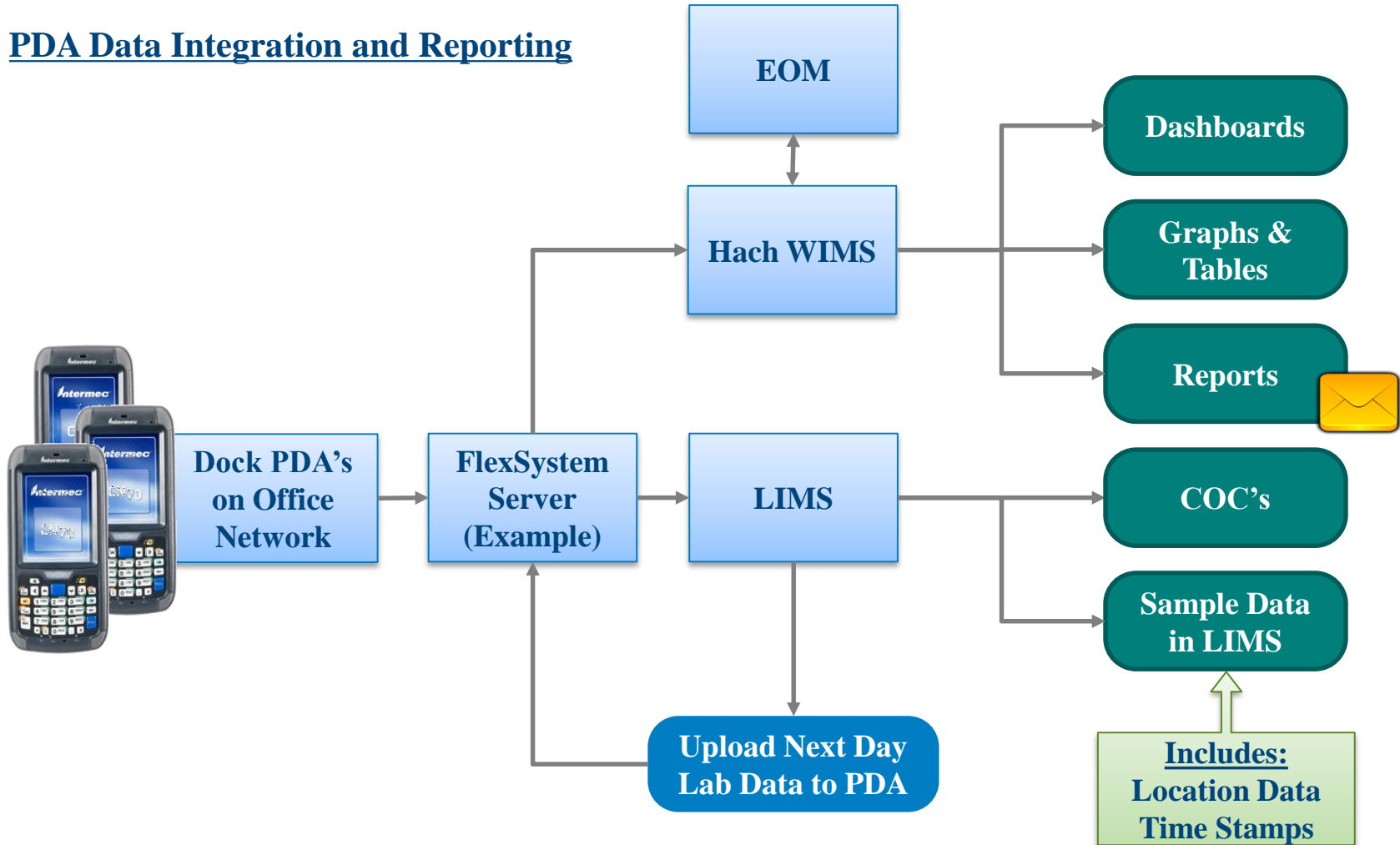| Work Maintenance Request | → | Scan Maintenance Barcode to Request Work | → | Follow PDA Screens to Complete Request | → | Data Is Validated and Stored Locally on PDA |
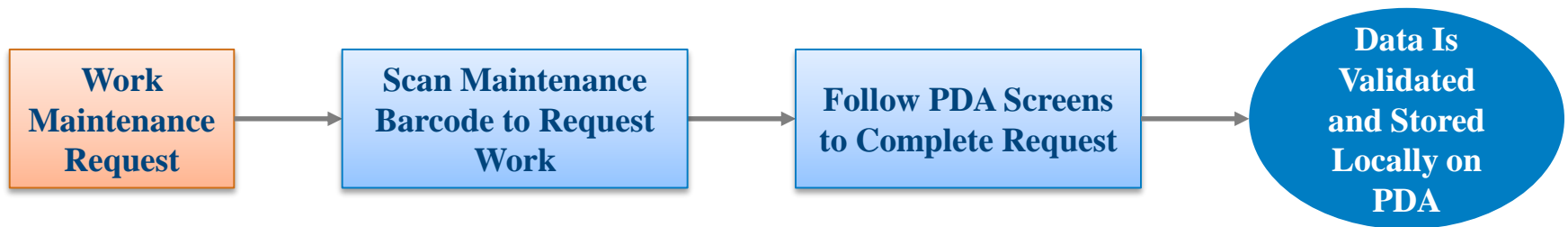
Orange Barcode Tags

Data Integration
Plant Walk-throughs – Collect More Information in Less Time

PDA Data Integration and Reporting

Data Integration

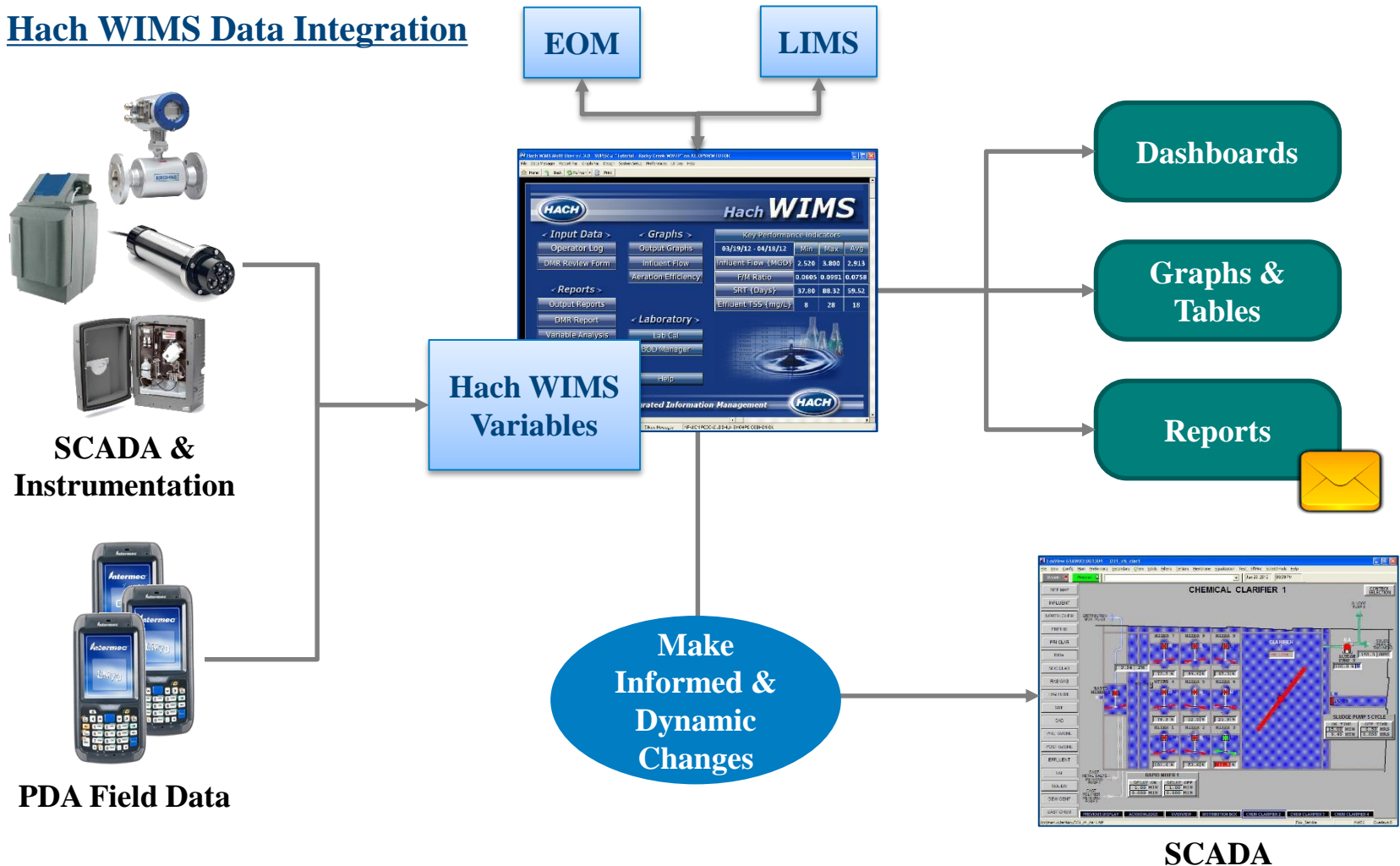Plant Walk-throughs – Collect More Information in Less Time

- **Key Benefits**
  - Working SMARTER - better use of operator time
  - Spend more time operating and less time collecting and managing data
  - Make sure the right data is captured where and when you need it to be collected
  - Allow more time for data analysis
  - Store defensible and discoverable electronic data (e.g. proof of plant inspections)
  - Connects field data to analysis and reporting in Hach WIMS, LIMS and other systems

- **Improve Data and Processes**
  - Eliminate multiple data entry points and associated errors
  - Eliminate pen and paper data gathering
  - Eliminate inconsistent sample locations
  - Eliminate paper chain of custody forms

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Plant Operation –
Decision Making with More Information

Data Integration

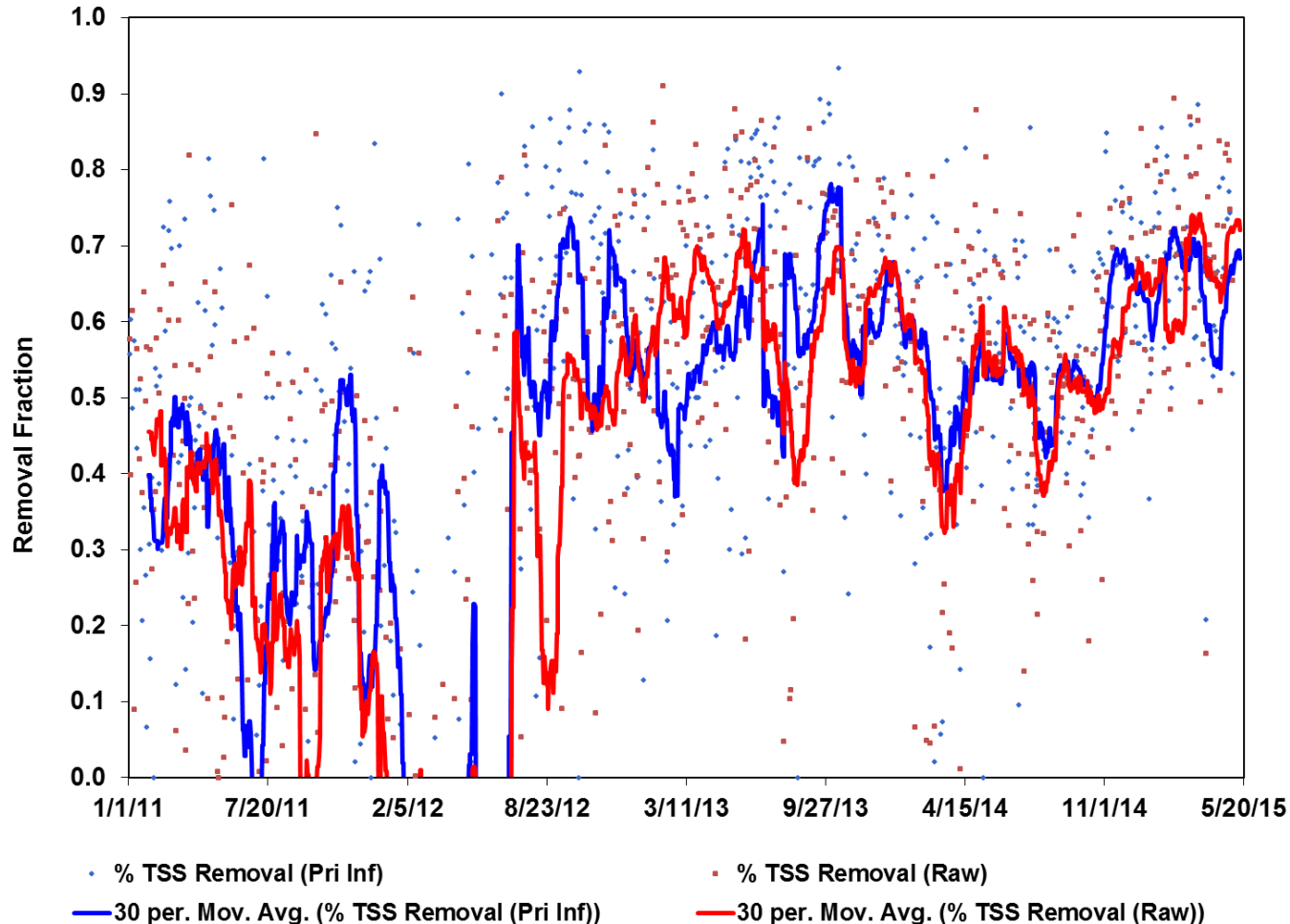- Plant Operation - Decision Making with More Information

Data Integration

Plant Operation - Decision Making with More Information

Data trends at your fingertips

Data Integration

Plant Operation - Decision Making with More Information

Data trends at your fingertips

Data Integration

Plant Operation - Decision Making with More Information

<u>L/E WWTP Example – Maintenance Decisions using SCADA data</u>

- Blowers do not have enough turndown to supply minimum air requirement

- Viewed power consumption of blowers vs. % open of surge valve

- Noticed that 1 blower was consuming a lot of energy without surge valve opening while another was consuming much less with surge valve opening very often

- Met with maintenance group to prioritize maintenance of that particular blower and found issues with the impeller

Data Integration

Plant Operation - Decision Making with More Information

- **Key Benefits**
  - Access information in one place – on your personal Hach WIMS dashboard(s)
  - Distill large data sets into usable information – tables and graphs
  - Automatically generate reports based on incoming data from other data sources
  - Make it easy to monitor data and change the way data is presented
  - Save money

- **Improve Data and Processes**
  - Make your LIMS data more accessible
  - Make your SCADA data easier to use and more accessible
  - Eliminate paper chain of custody forms

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Data Integration
Plant Operation - Decision Making with More Information
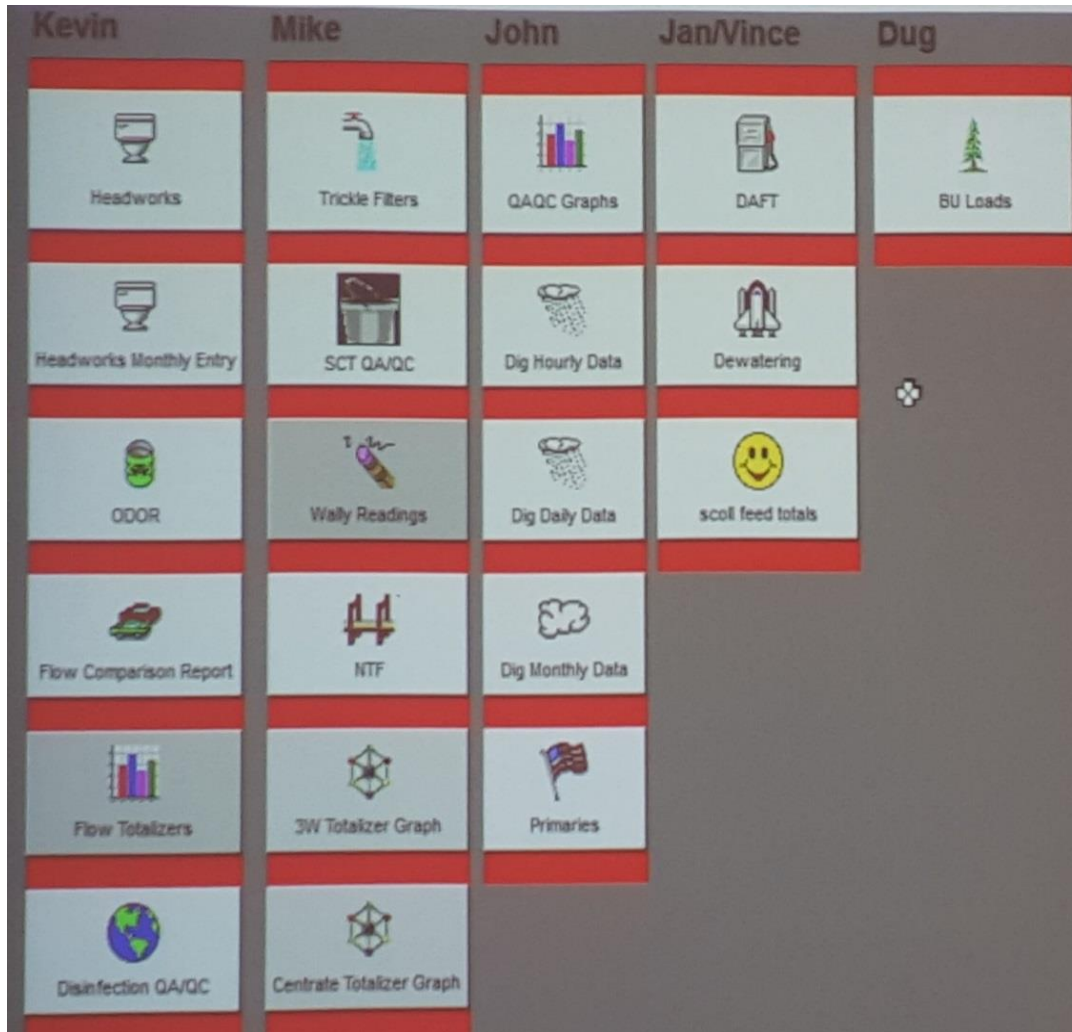
- L/E WWTP created a simplified dashboard for the Operators.

- This dashboard shows the setup for Operators but each Operator would only see their items.

- This dashboard only shows the tasks the Field Operators are responsible for.

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Updating to an EOM

EOM and Data Integration
Recommendations & Roadmap

- **Updated EOM – Needs Analysis**
  - Quantify and categorize safety information, SOP's and other EOM resources
  - Identify recent and ongoing changes that impact EOM documentation
  - Define organizational goals for EOM (recommendations outlined herein)
  - Identify all users, user groups, and access requirements
  - Identify support needs and limitations
- **Updated EOM - Software Testing & Selection**
  - Identify short-list of commercially off the shelf solutions that meet organizational needs
  - Test selected solutions with sample user from different groups
  - Seek input from other customers for selected solution(s)
  - Seek optimum long-term licensing agreement for selected solution(s)

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EOM and Data Integration

Recommendations & Roadmap

- **Updated EOM – Key Benefits**
  - Be able to easily make changes to EOM documentation without 3rd party support
  - Include more types of information in a single EOM solutions
    - e.g. P&ID's, Record Drawing, Videos, Photos, and other multimedia information
  - Enhance the ease and effectiveness of using search features in an EOM to find the information you need when you need it
  - Eliminate costs for custom development by implementing a scalable commercially off the shelf software that is supported by a software company with a dependable roadmap
  - Be able to share EOM documentation in multiple formats in other systems (e.g. Hach WIMS, mobile software on PDA's, and other software used)
  - Be confident that the information you create will be put into a electronic format in a library that will easily scale and grow with your organization – be confident that you are not wasting the valuable time of your staff

Field Data Collection (FlexSystems or other)

Field Data Collection and Data Integration

Recommendations & Roadmap

- **Field Data Collection (FlexSystems or other)**
  - Conduct Needs Analysis - identify users and user groups
  - Identify data collection and monitoring tasks that could most benefit from using PDA's
  - Identify potential software solutions (in addition to FlexSytems)
  - Identify hardware requirements and options
  - Conduct pilot of propose solution(s)
  - Identify support requirements (in-house and 3rd party)
  - Develop roadmap for tasks should include automation using the PDA's
  - Develop training and communication program for solution
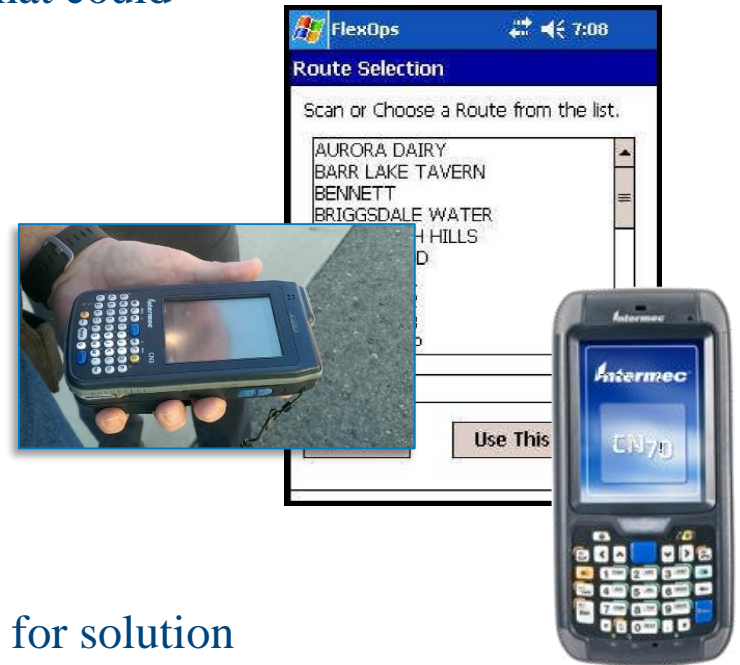
Field Data Collection and Data Integration
Recommendations & Roadmap

- **Field Data Collection - Key Benefits**
  - Get to more tasks without adding more staff/ make better use of operator time
  - Spend more time operating and less time collecting and managing data
  - Make sure the right data is captured where and when you need it to be collected
  - Allow more time for data analysis
  - Store defensible and discoverable electronic data (e.g. proof of plant inspections)
  - Connects field data to analysis and reporting in Hach WIMS, LIMS and other systems

- **Field Data Collection - Improve Data and Processes**
  - Eliminate multiple data entry points and associated errors
  - Eliminate pen and paper data gathering
  - Eliminate inconsistent sample locations
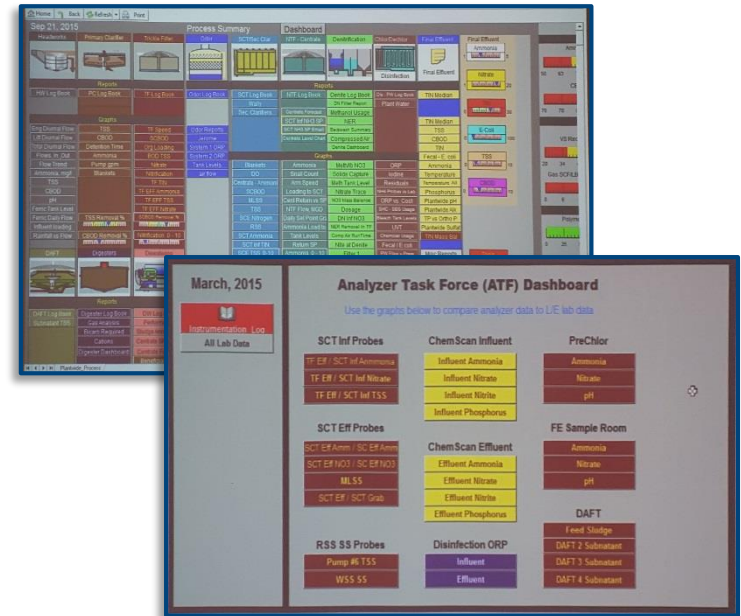 - Eliminate paper chain of custody forms

Hach WIMS Dashboards and Reporting

L/E Hach WIMS and Dashboard
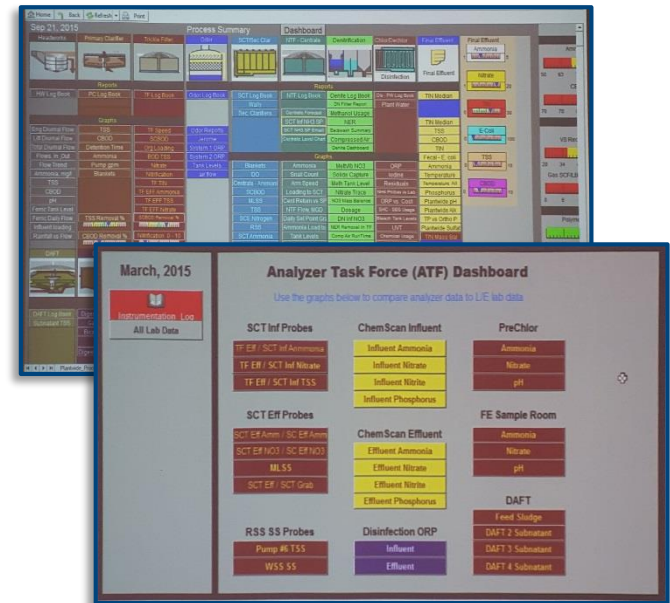
Recommendations & Roadmap

- **Hach WIMS Dashboards and Reporting**

  - There may be areas of Hach WIMS that can be expanded or otherwise improved upon that would help improve operational awareness and efficiency

  - Review and document Hach WIMS variables, calculations, and other configurations

  - Educate staff/users on all the potential uses for Hach WIMS

  - Conduct needs analysis with staff/users

  - Quantify and document functionality gap

  - Identify internal Hach WIMS champion(s) that will be system admin and take the lead with rolling out new Hach WIMS features

  - Implement, test, improve and deploy new Hach WIMS features

Hach WIMS and Dashboard
Recommendations & Roadmap

- **Hach WIMS Dashboards and Reporting**

  - Plant automation

  - Online analyzers free up operator sampling/analysis time and increase data resolution from grab snapshots/day to constant data feed.

  - Manual testing is expensive for on-going grab sample results of process performance at limited discrete times each day

  - On-line ammonia analyzers, for example, have enabled plant staff to optimize and further refine blower control when compared to just dissolved oxygen monitoring (typically, ammonia control provides for +25% additional energy reduction when compared to just dissolved oxygen)

Hach WIMS and Dashboard

Recommendations & Roadmap

- **Key Benefits**

  - Get more ROI on Hach WIMS investments

  - Access information in one place – on you personal Hach WIMS dashboard(s)

  - Distill large data sets into usable information – tables and graphs

  - Automatically generate reports based on incoming data from other data sources (Silos)

  - Make it easy to monitor data and change the way data is presented

  - Save money

Digitizing and Integrating Data Requires More In House Training for Staff to be "Integrated"

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Digitizing and Integrating Data Results In Orienting to Performance Based Training…

- Focused on operations function and results, rather than theory of operation.

- Clarify the relationship between monitoring, response and the subsequent impact to plant performance.

- Target specific performance outcomes rather than broad applicable skills – broad skills may not be clear to staff as to how they apply to the job or change an outcome

- Provide assessment and gap analysis to firm up KPIs (Key Performance Indicators) and provide the necessary training and IMS (information management system) recommendations

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Digitizing and Integrating Data Results In Orienting to Performance Based Training…

- Identify subject matter experts within the organization
  - "Institutional Knowledge" will need to be formalized over time

- Refine performance objectives and "train the trainer" (a SME/Supervisor)
  - Teach new skills where necessary
  - Develop a resource tool kit (BMPs/SOPs)

- Supervisor/SME based training is the long-term solution for increasing plant performance
  - Supervisor/SME mentoring and providing future training is necessary for a long term transition to sustain plant performance

Digitizing and Integrating Data Results In Orienting to Performance Based Training…

- Develop "performance based training" approach to:
  - Utilize process knowledge of staff subject matter experts
  - Supplement process knowledge of SMEs and staff
  - Structure mitigation of performance limiting factors
  - Structure process performance objective feedback:
    - Measure/monitor KPIs
    - Provide suggestions for additional KPI monitoring
    - Provide systems to process and reduce data stream to management
    - Document performance improvement with processed data/KPI trends

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If the data pyramid of information flow is not managed….

- Too much time and effort producing and retrieving too much data
- Not enough time to analyze data and optimize
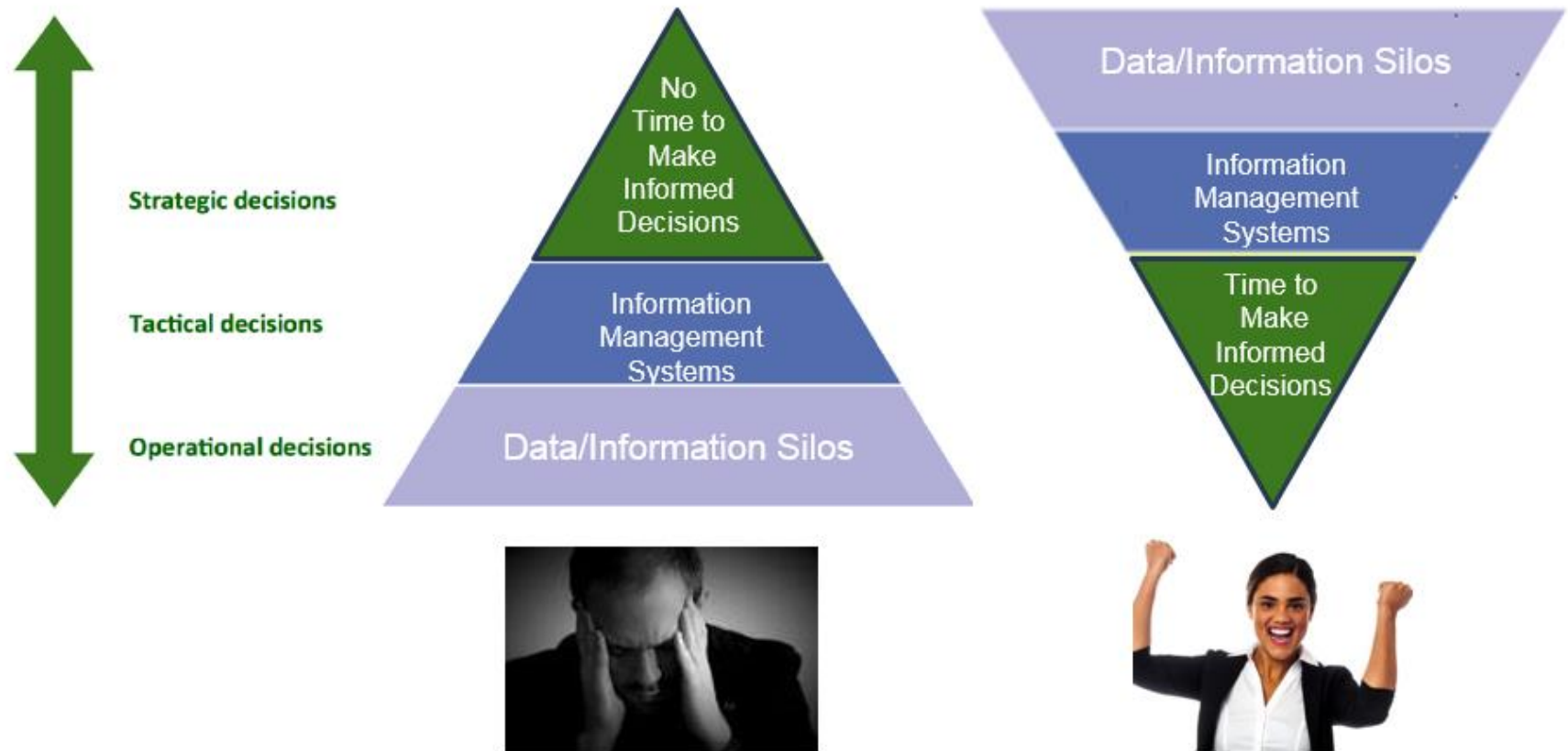
Questions

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