Customized DCS Training in a Technical Age
Training the Modern Day Wastewater Operator
DCS Back in the Old Days…
DCS Back in the Old Days...

**ON COMPUTER**

1. **SUMMARY, 4 UPPPER, 1 POIN**T AT WHICH TIME THE FOLLOWING APPEARS ON SCREEN:

1. HS 018A XIB
2. HS 018Z XIB
3. IL 018 C
4. OA 018A
5. FL 972W
6. HS 019A XIB
7. HS 019Z XIB
8. IL 019 B
9. OA 019 A
10. FL 972X
11. IL 972A
12. IL 972B
DCS Back in the Old Days…

1996 Fischer Porter System – Now ABB
Today…

- Operating is More Complicated
  - Equipment increasingly automated
- Regulations tighter
  - Less room for errors
- Proper training is important
DCS Training Evolution
DCS Training Evolution

- Effective training easier for a single piece of equipment
  - Vendor explains parts, operation and troubleshooting
  - Focus is on one piece of equipment
DCS Training Evolution

- DCS training covers many devices and pieces of equipment that interact together
  - Lots of details
  - Control can be very complex
  - Understanding troubleshooting very important
  - Operation through DCS is 50% of equipment operation
DCS Training Evolution

Old Way of Training:

- Programmer worked with one or two staff members
  - Training ‘trickled down’

- Inefficient for a large plant with a large number of staff
  - Multiple shifts of operators
  - Difficult to communicate with other shifts
DCS Training Evolution

New Ideas on Training:

Train everyone!

But how?
DCS Training Evolution

Struggled in the Beginning

- Started with generic DeltaV training
- Covered basics of:
  - Hardware
  - Navigation
  - Faceplates
  - Trends
  - Alarming
  - Etc.

- Training was okay but:
  - Too far in advance for some
  - Graphics where not our graphics
  - Didn’t capture custom changes implemented for us (to faceplates and graphics)
DCS Training Evolution

Basic Training Followed by Area Specific DCS Training

- Consisted of a PowerPoint
  - Pictures of graphics
  - Programmer discussed graphics
  - Slides contained little information

- This wasn’t great
  - No helpful information to refer back to
  - No exposure to actual system
  - Difficult to process information without hands-on experience
DCS Training Evolution

Wet Well 1
DCS Training Evolution

- **Catch 22**
  - Need ‘live’ system to do effective hands-on training
  - Areas can’t go ‘live’ until everyone has been trained in how to operate
Factory Acceptance Testing (FAT) provided what we needed
- Observe programming and graphics in a test environment
  - Start/stop equipment
  - Witness response to parameter changes
  - See response to failures
- Observe alarms
New and Improved Training:

- At vendor location
- Improved PowerPoint
- More description
- Introduced graphics
- Highlighted important faceplates and their parts
- Explained sequences
- Details in package could be used for later reference
DCS Training Evolution

Distribution Conveyor Sequence Control

- The master sequence controls what conveyor to start, what direction to run and how often to open and close the chute gates depending on process conditions and operator selection.
DCS Training Evolution

Distribution Conveyor Sequence Control

- **Centrifuge To Conveyor Selection:**
  - The operator will select which distribution conveyor each centrifuge will feed into.
  - In this example GC-118A is selected to be used for all three centrifuges.
  - Centrifuge to conveyor selection is only available when there is a duty/duty configuration.
  - Duty/duty is used when both distribution conveyors are to be ran at the same time.
  - When in a duty/standby configuration, or when there is only one conveyor available, the selection will always follow the running or selected conveyor.
  - Changing this selection will control the gate on the bottom of the classifying conveyor.

![Centrifuge To Conveyor Selection](image)
DCS Training Evolution

Part 2 of training at vendor location:

- Hands-on
  - Used test computers
  - Selected FAT test cases
  - Forced people to think

1. **Conveyor start**

Goal: Start distribution conveyor B25A-GC-118A to feed silo 1 when centrifuge 1 sequence starts.

<table>
<thead>
<tr>
<th>Required Actions</th>
<th>Expected Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ensure the distribution conveyor sequence is Enabled.</td>
<td>1. The distribution conveyor will start in reverse.</td>
</tr>
<tr>
<td>2. Select conveyor B25A-GC-118A as duty using the selection matrix on the sequence faceplate.</td>
<td>2. Gate 1 will close and chute 1 will be fed for the pre-determined time set in the detail faceplate.</td>
</tr>
<tr>
<td>3. Select conveyor B25A-GC-119A as out of service.</td>
<td>3. When the chute 1 feed time elapses, gate 1 will open and chute 2 will be fed for the pre-determined time set in the detail faceplate.</td>
</tr>
<tr>
<td>4. Click the APPLY button.</td>
<td>4. Cycle repeats.</td>
</tr>
<tr>
<td>5. Select silo 1 for operation.</td>
<td></td>
</tr>
<tr>
<td>6. De-select silo 2 to be not in operation.</td>
<td></td>
</tr>
<tr>
<td>7. Use the CENT 2 SIM button to simulate a centrifuge starting.</td>
<td></td>
</tr>
</tbody>
</table>
DCS Training Evolution

- **Drawbacks**
  - Off-site
  - Only two test systems
  - One time presentation
    - No opportunity for future training or staff that missed
SCADA Training Evolution

- Programmer suggested we look into Mimic
  - Allows use on site
  - Could be used for future training
- We were fortunate to be able to purchase a system
Mimic System

- Began use in April 2019
  - UV training
- On site
- Training can be reused for new people (no longer one time only)
- Can be used on weekends and nights
- Station can be used for testing program changes offline

## 2. Shutdown a UV Channel

**Goal:** Put a channel O/S using the priority assignment.

<table>
<thead>
<tr>
<th>Required Actions</th>
<th>Expected Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. On the Overview graphic, open the channel control sequence and ensure Channel 11 is running.</td>
<td>1. On the Channel 11 graphic, bank control sequence initiates a shutdown, and is disabled.</td>
</tr>
<tr>
<td>2. Assign priority 0 to Channel 11 and click apply.</td>
<td>2. Inlet gate CW-110A closes.</td>
</tr>
<tr>
<td></td>
<td>3. UV banks turn OFF, and power for all banks stays at last value.</td>
</tr>
<tr>
<td></td>
<td>4. Outlet gate CG-110F fully opens.</td>
</tr>
<tr>
<td></td>
<td>5. Channel starts to drain, and LAL-110K is back in Alarm (see faceplate) when level (LI-110I) &lt; 1.0 m.</td>
</tr>
</tbody>
</table>
SCADA Training Evolution

Drawbacks

- Still only two stations
- Stations are not independent
  - What happens on one also happens on the other
Mimic System

- Found cost savings on test cases already developed for FAT and used in previous training
  - For one area, cost of development was less than half what it would have been by utilizing previous work
SCADA Training Evolution

- Test case development now included in training budget for new areas
- DCS hands-on training now incorporated in training new operators on different areas of the plant (under development)
Questions???