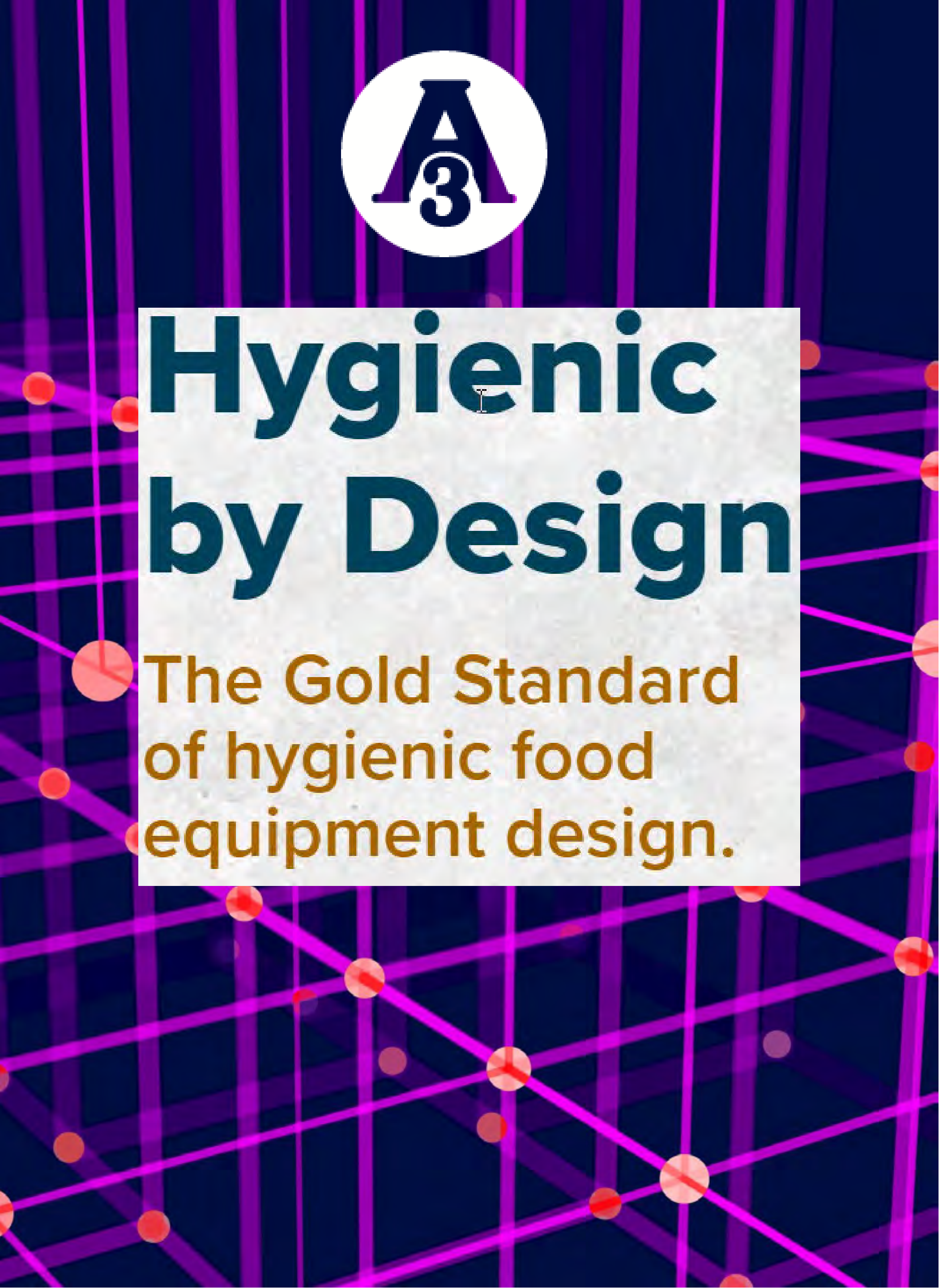

Options For Sanitation Automation – CIP/COP

Continuing Education Series

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Z to A
Can You Do It?

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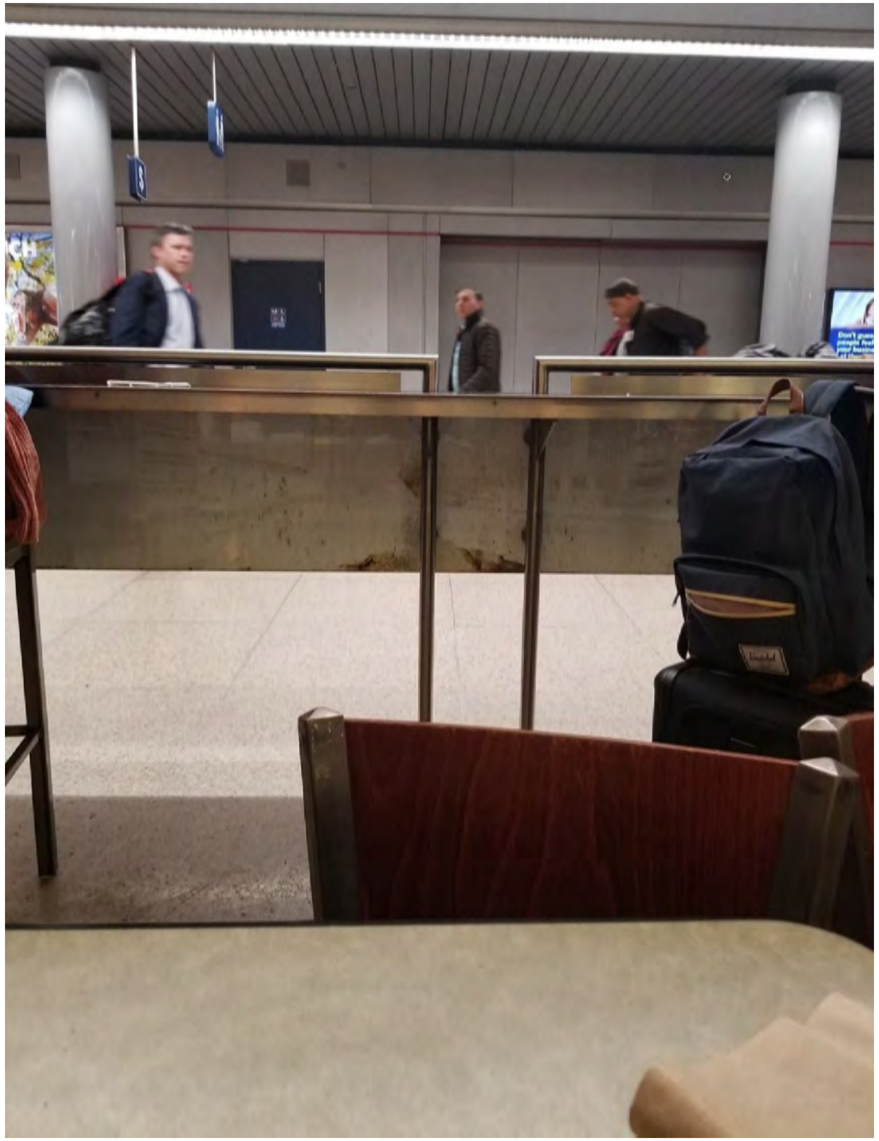
NEVER BUY A DOG WHEN YOU'RE DRUNK



The “Devil” is always in the details!

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Two **Hospital** Drinking Fountains

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Goals

- A review of the goals and expected outcome of CIP automation planning, installation and verification activities. Almost anyone can sell you tanks, pumps and valves.

- Follow The Water!!

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Process Description

"The Starting Point"

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A Process Description Includes:

A functional description of the process.

Highlighted circuit layout drawings with estimated circuit holdup volumes.

A well-defined description of each portion of the process and the components within each individual process.

Circuit single seat and mix proof valves in circuit in defined worksheet for not only I/O check out but for verification documentation.

Why Is All That Important?

- Someday someone in the future is going to figure out what is going wrong with the system and the stronger the blueprint the shorter the corrective action battle duration will likely be.
- As people are rapidly changing over positions there needs to be documentation stability.

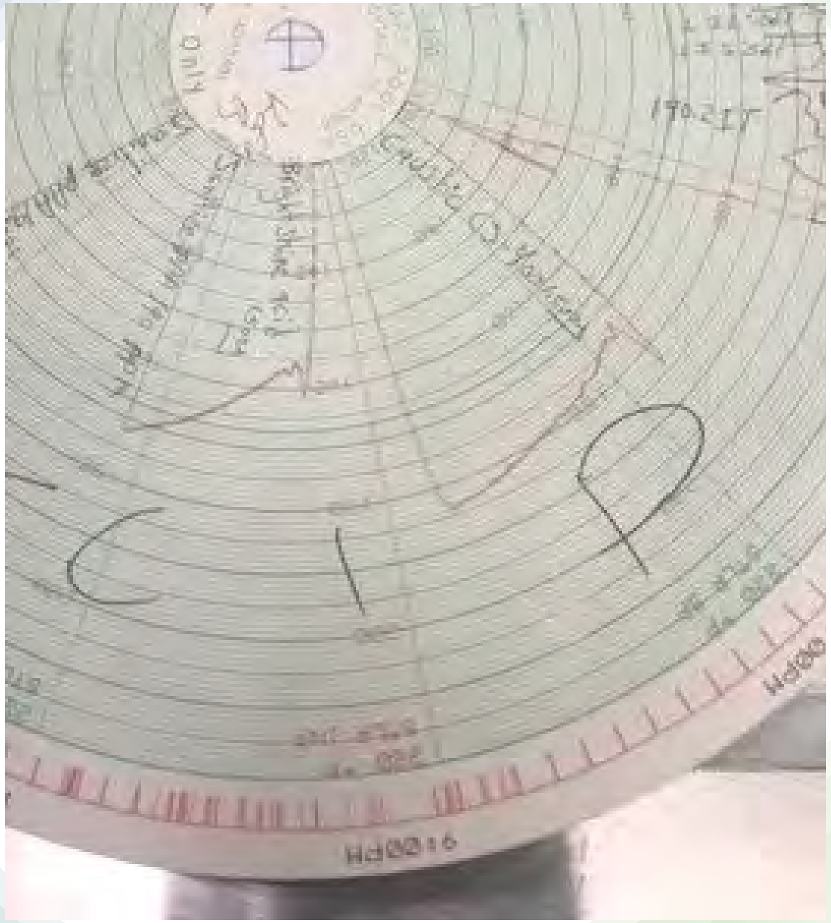
Current State:
(a supplier reality check)

- Everyone says they are CIP and Process experts……..why wouldn’t they?
- Number of **<u>true</u>** CIP subject matter experts is declining.
- Complexity of systems is increasing exponentially. Mix-proof valve use in systems are increasing
- Most integrators want to get in and get out as fast as possible. Dwell time is $$!
- Recruiting people that want to invest the time to truly understand the CIP process is nearly impossible.

- ??? – Where does that put us in the future??

HTST EOR + CIP Chart

- Knowing <u>*what*</u> you are looking **<u>AT</u>** and knowing if there if there is something *wrong with <u>IT</u>*.



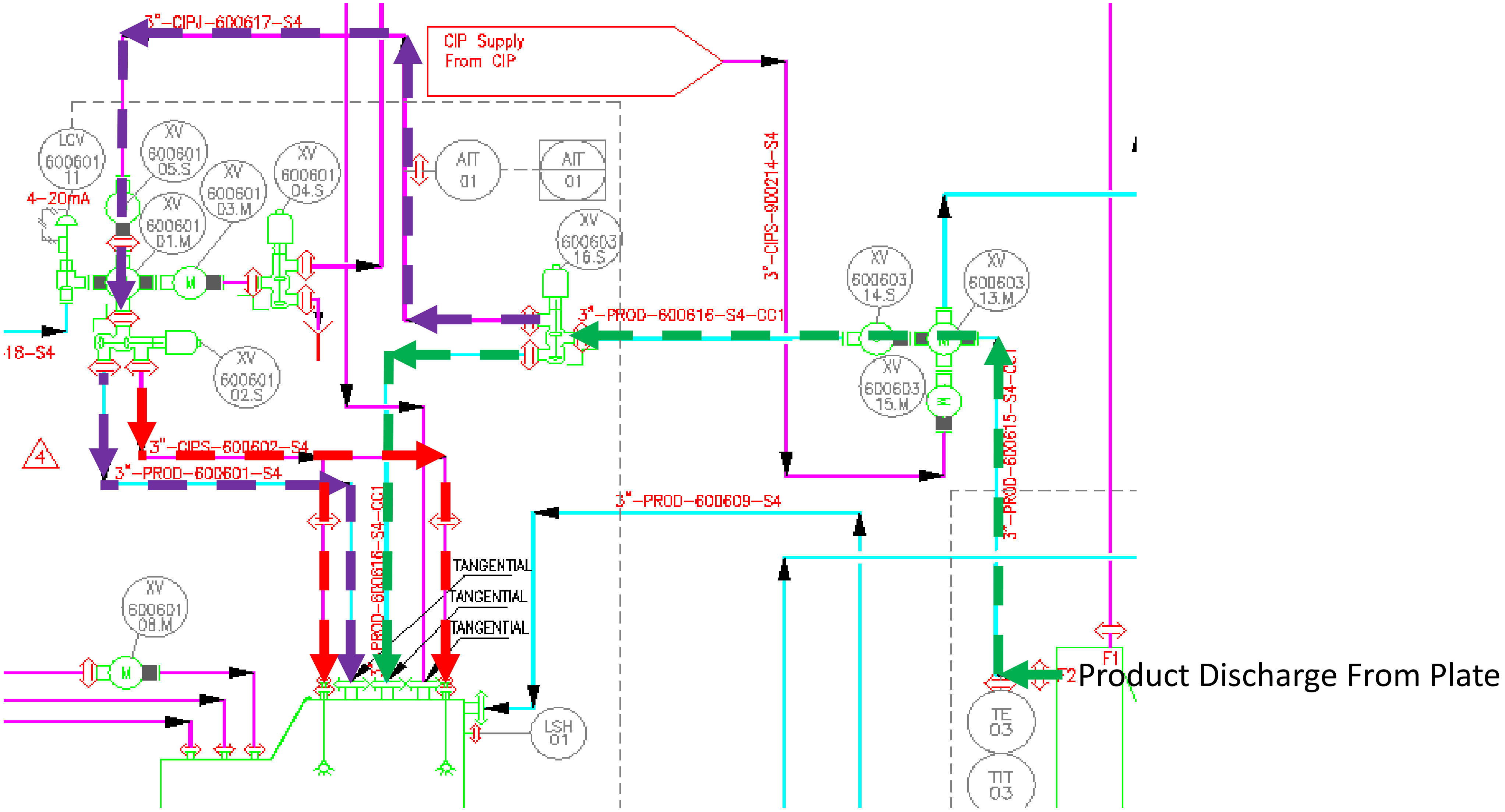
Process Design Review

Work as a collaborative team to complete process design reviews prior to equipment being installed at the field level.

Who are the perfect PDR team members?

- Engineers
  - Process – Mechanical - Electrical
- Safety Representation
- Operators
- Outside Technical Resources

PDR Example…..and discovery!



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Design Qualification - DQ

- During design qualification, all components, assemblies, system parts, filters and controls are documented in order to prove that they correspond to the intended design and are suitable for the intended purpose.

Installation Qualification - IQ

- Installation qualification is documented proof that the equipment, systems and components in the installed or modified version meet the previously defined requirements.

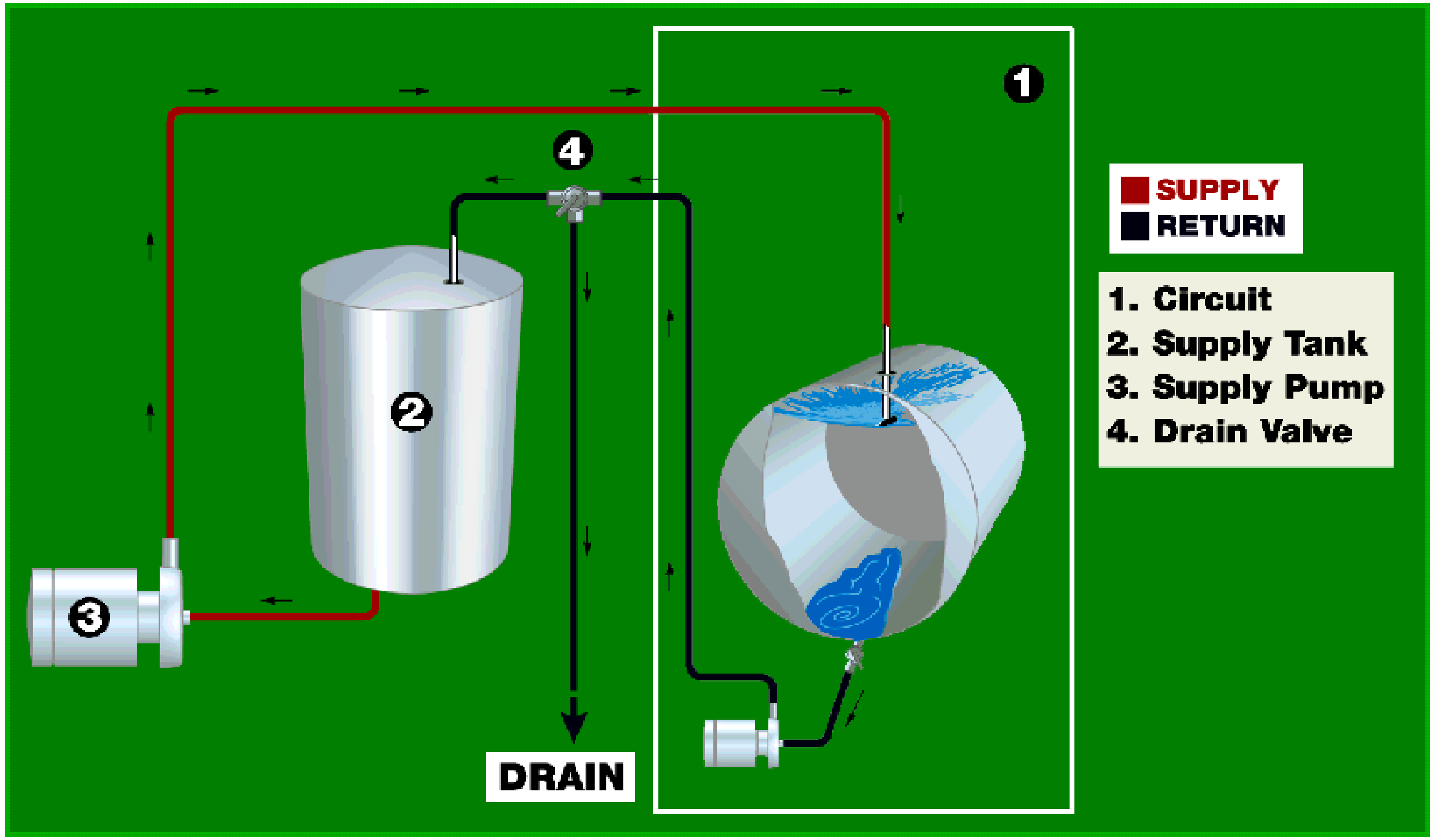
Operation Qualification - OQ

- During operation qualification, the functions of the system or the equipment are checked for compliance with the requirements.

Performance Qualification - PQ

- Performance qualification demonstrates that the premises and infrastructure systems, in combination with the production equipment, are suitable for manufacturing products of the agreed quality in a **reproducible and sustainable** manner.

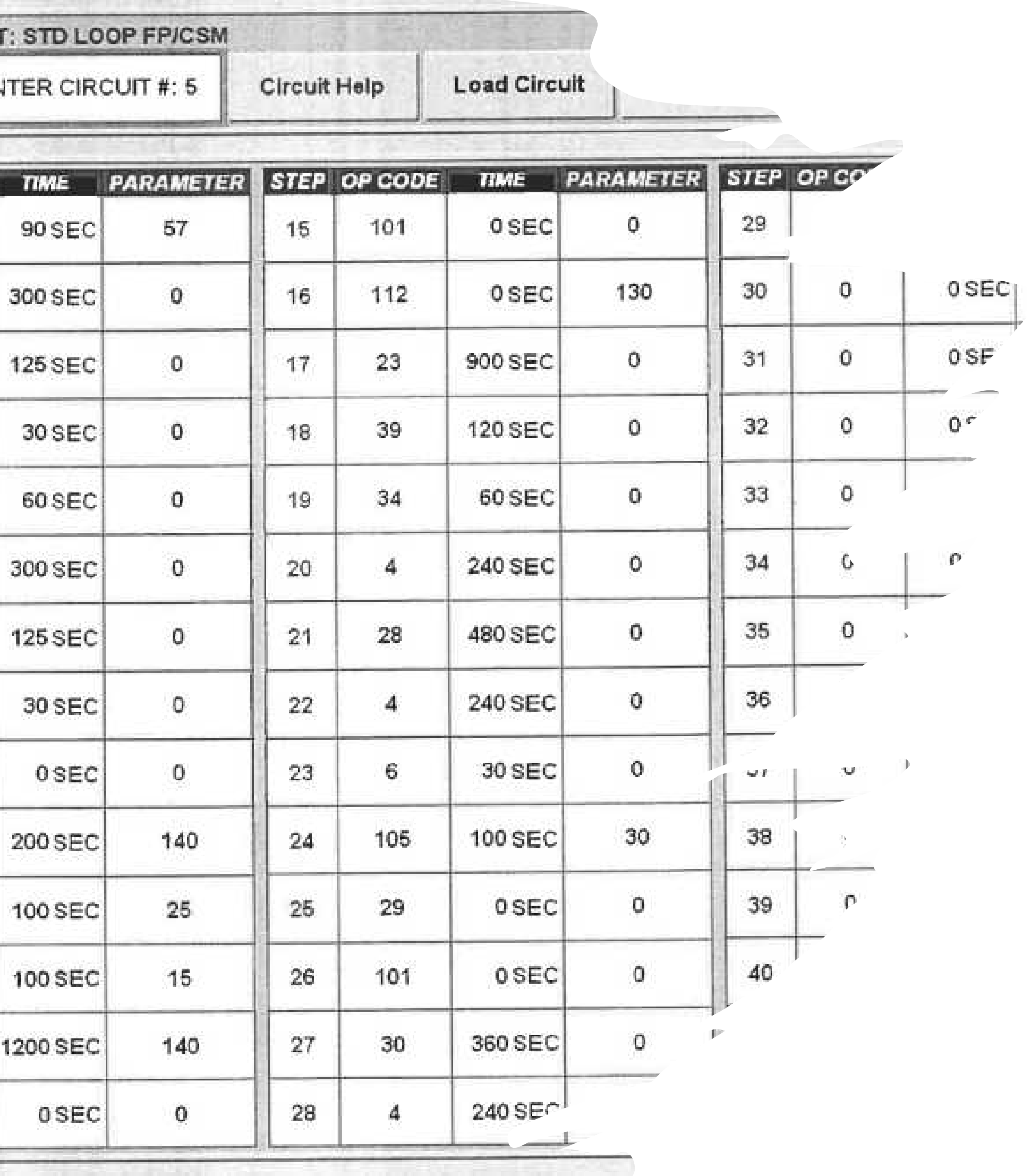
Basic CIP Circuit Diagram Example



It all starts with the most basic of circuits.

Basic CIP Pinning Chart Documentation is <u>CRITICAL</u>

CIP Chart - Tank Program **Single Use - Solution Recovery**										**Ref. Figure 6** **X=Active/On**	
FUNCTION	**VALUE**	Supply Tank Outlet Valve	Supply Tank Inlet Valve	Fresh Water Valve	Return Check Probe	Recovery Tank Outlet Valve #3	Recovery Tank Return Valve #4	CIP Supply Pump	Steam Valve	Return Pump	Drain Valve
nse - Fresh Water	40 sec.	X		X				X			
ain to Sewer	60 sec.			X						X	
turn Check				X	X					X	
nse - Recovered	25 sec.			X		X		X		X	
ain to Sewer	45 sec.			X						X	
nse - Recovered	25 sec.			X		X		X		X	
ain to Sewer	45 sec.			X						X	
mp Down	50 sec.	X		X				X			
tablish Circulation	10 sec.							X		X	X
eam On	140º F							X	X	X	X
d Alkaline Det.	37 sec.							X	X	X	X
lay to Temperature	140º F							X	X	X	X
rculate-Wash	18 min.							X	X	X	X
eam Off - Circulate	2 min.							X		X	X
ain to Recovered	60 sec.			X			X			X	X
nse - Fresh Water	45 sec.	X		X				X		X	
ain to Recovered	60 sec.			X			X			X	X
nse - Fresh Water	45 sec.	X		X				X		X	
ain to Recovered	60 sec.			X			X			X	X
mp Down	50 sec.	X		X				X			
tablish Circulation	10 sec.							X		X	X
d Sanitizer	20 sec.							X		X	X
rculate-Sanitizer	*							X		X	X
ain to Sewer	60 sec.									X	
ut Down											



T: STD LOOP FP/CSM

NTER CIRCUIT #: 5 | Circuit Help | Load Circuit

TIME	PARAMETER	STEP	OP CODE	TIME	PARAMETER	STEP	OP CO	
90 SEC	57	15	101	0 SEC	0	29		
300 SEC	0	16	112	0 SEC	130	30	0	0 SEC
125 SEC	0	17	23	900 SEC	0	31	0	0 SE
30 SEC	0	18	39	120 SEC	0	32	0	0
60 SEC	0	19	34	60 SEC	0	33	0	
300 SEC	0	20	4	240 SEC	0	34	0	
125 SEC	0	21	28	480 SEC	0	35	0	
30 SEC	0	22	4	240 SEC	0	36		
0 SEC	0	23	6	30 SEC	0	[illegible]		
200 SEC	140	24	105	100 SEC	30	38		
100 SEC	25	25	29	0 SEC	0	39	0	
100 SEC	15	26	101	0 SEC	0	40		
1200 SEC	140	27	30	360 SEC	0			
0 SEC	0	28	4	240 SEC				

CIP “Op” Codes Chart

- Key Issue– If the “OP” codes are not totally understood then following the process operations is a very tedious process. Must be simple and easy to comprehend. Operations and actions need to be on one concise document.
- Some will make things “seem” confusing to lock them in as a single source of support.

Optimization During Validation – A Novel Idea

It is significantly harder to fix things once everyone leaves.

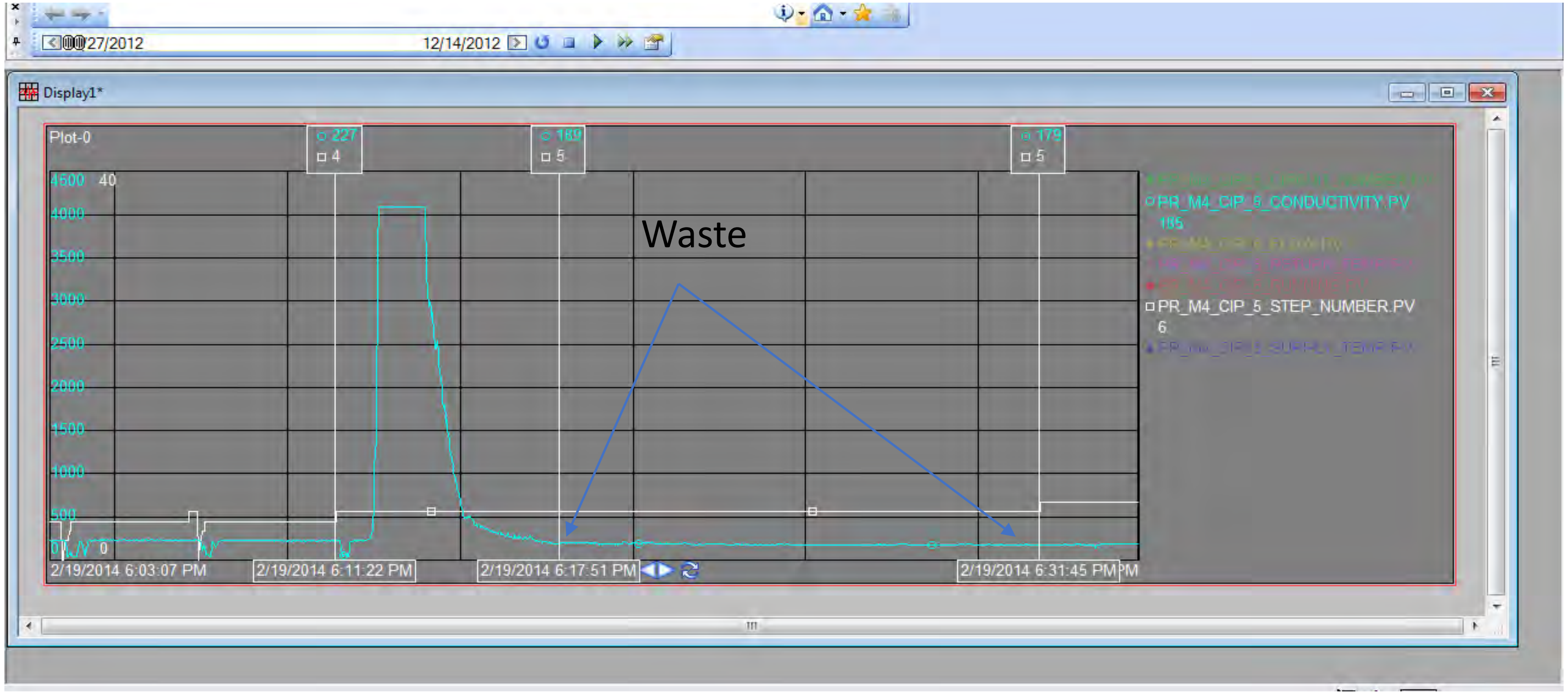
A Few Examples…

Optimization Baseline Data

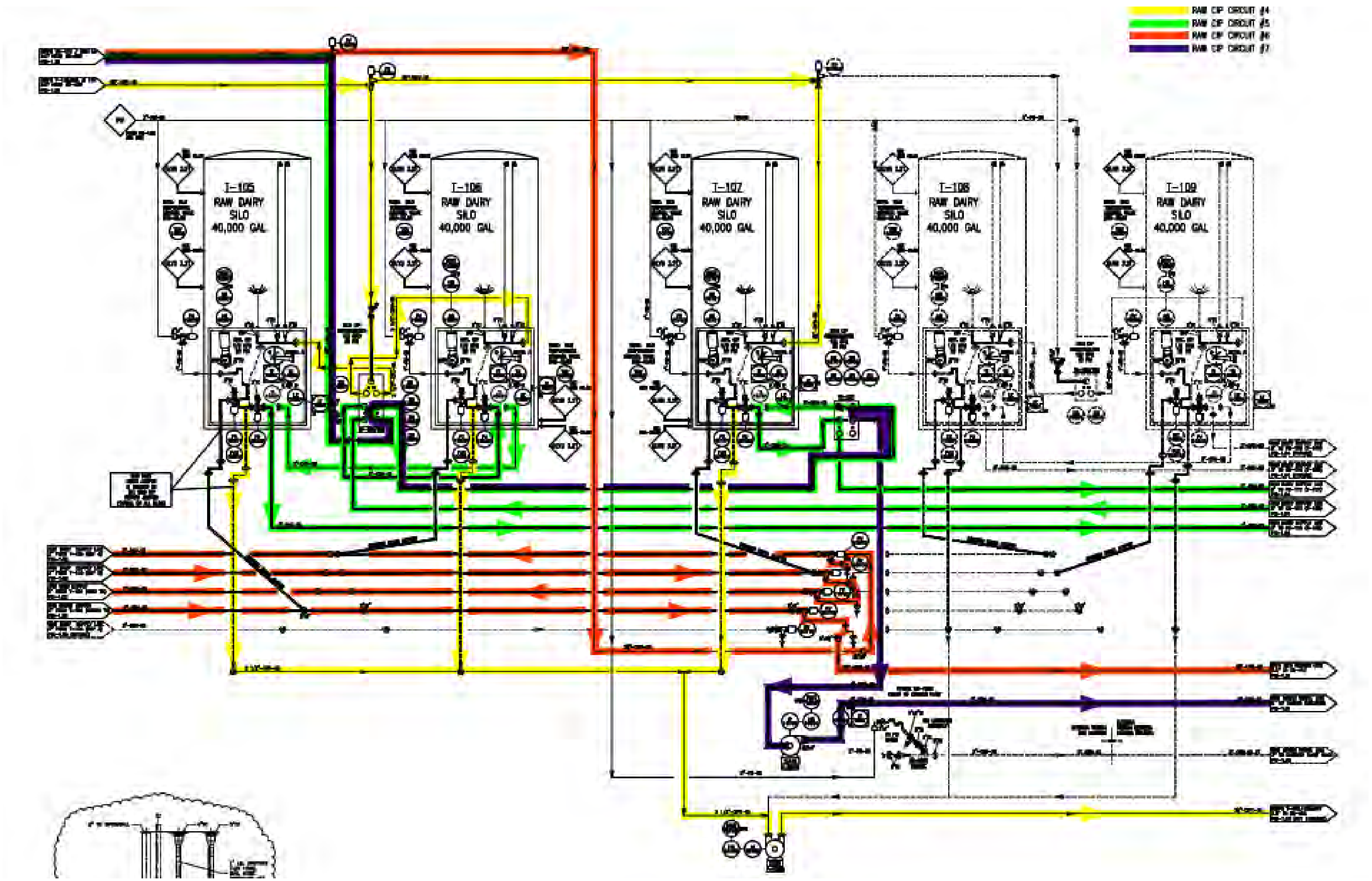
- The “test” factory did not have conductivity meters installed on the CIP return lines on many of the systems. The ones that were installed were not functioning properly.
  - In consideration that the factory had many CIP systems we focused on a “portion” of the systems with the highest load factor.
  - The load factor was determined by the operations team evaluating the past CIP utilization data.
  - The higher the load factor the greater the impact can be to the process, in most cases.

Actual “New” CIP Data

20 min total - 14 minutes of extra pre rinse at 120gpm at 125F
Annual 23hrs extra, and 168,000 gal H2O (water, sewer, energy aprox $2500)



CIP/P&ID Drawings – Showing Circuits



Color Coding of the circuit and flow paths makes optimization much easier to complete.

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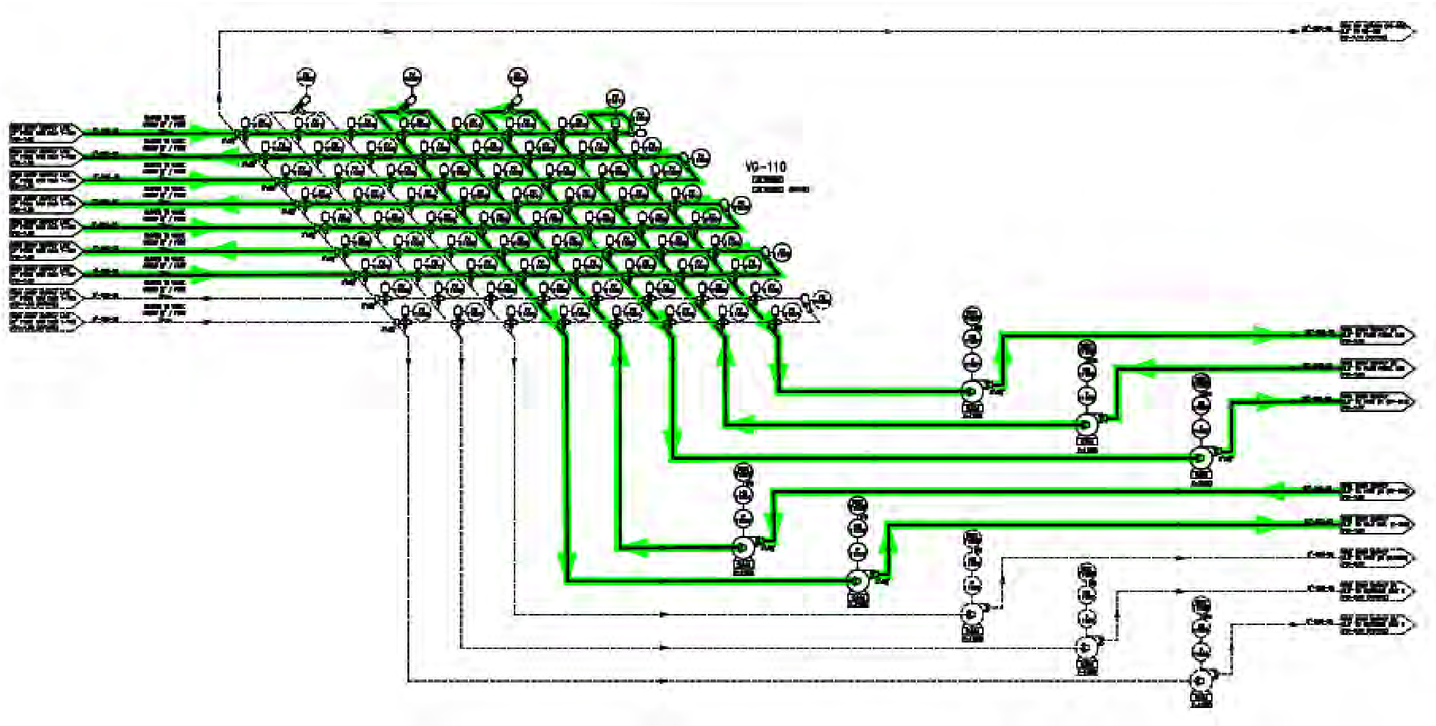
Complex Line Circuit Drawing – Single Seat Valves



- The initial CIP pinning on this line circuit alone accounted for a utility over use of 16,000,000 gallons of water per year. All 3” lines. $73,600 per year in water costs alone.
- Circuit time was dropped by 15% per night. Factory was capacity constrained on this items fed with this valve group.

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Gaps (Pain) Defined

This one circuit at the plant always messes up and costs us tons of downtime!!

I cannot make these pipe connections easily. It takes four people to move the pipes for proper alignment!!

This one pump kicks out all of the time, which causes the circuit to fail!!

This one tank "always" fills up with CIP rinse and wash solution!!

We cannot batch until the tank is done cleaning!

We have a ton of storage space for finished batches in another area of the plant….if we only had a line to get the product there we could be more productive!

There are reasonable root causes for everything!!

“In The Old Days” - CIP Unit Operations

- In years past, operators had hands on contact with the items being cleaned. They knew where things started and where they ended and, in many cases, they knew what happened in between.
- With the “new”, more complex and every changing systems there is less and less operator involvement which also can lead to systemic failures that could go undetected for days or event weeks.

Example of CIP Issue List For One CIP Unit

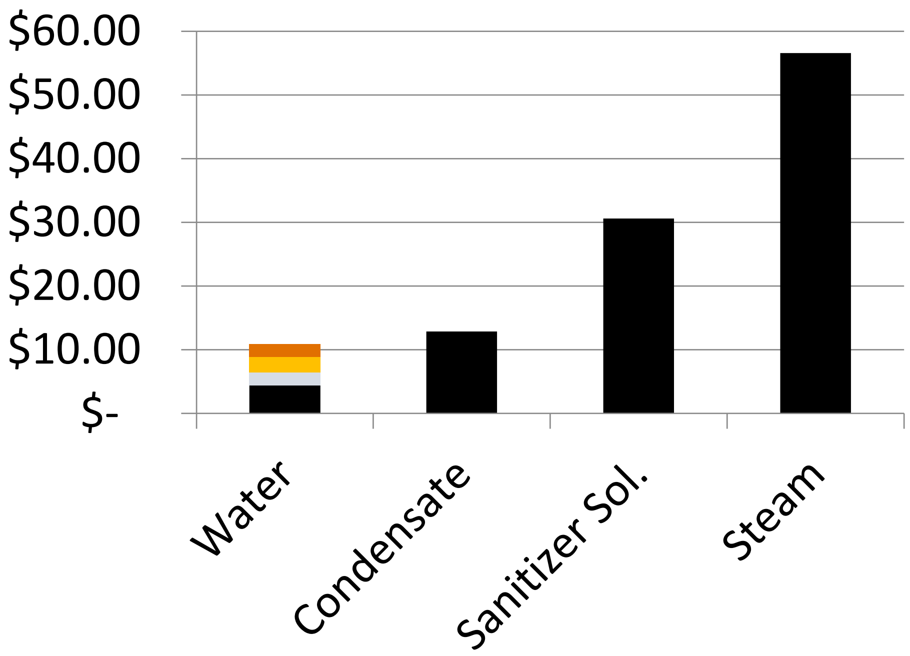
Unit	Circuit	Step	Problem
5	CSM Receiving	3	Fault interrupt return check
5	Shipping Line	3	Fault interrupt return check
5	Std Loop FP/CSM	3	Fault interrupt return check
5	AC/PIW		Fault interrupt return check
5	AC/PIW		Fault interrupt return check
5	AC/PIW		Not pumping in Acid
5	AC/PIW		Not pumping in Acid
5	All		Acid pump only works when you manually trigger the selnoid in cabinent (SAFETY CONCERN)
5	All		Acid pump only works when you manually trigger the selnoid in cabinent (SAFETY CONCERN)
5	All		Not pumping in Acid
5	Shipping Line		Not pumping in Acid
5	Shipping Line		Not pumping in Acid
5	CSM Receiving		Not pumping in Acid
5	Std Loop FP/CSM		Not pumping in Acid
5	FP-27		Not pumping in Acid
5	FP-27 w / line	30	Not pumping in Acid
5	Std tub		Not pumping in Acid
5	PIF C		Force on jumper at PH 2000 (electric shop)

- Please note that a majority of the above items involve either chemical dispensing issues or return check issues. (we found a defective return check probe)

What is it important to have all the utility information for the factory?

Different utility streams have different financial impacts:

Stream	$/1000 Gal
Raw City Water	$4.43
Softened City Water	$6.45
Warm soft. Water (100F)	$8.93
Hot Soft Water (140F)	$10.92
Condensate	$12.90
Sanitized Water	$30.63
Steam	$56.56



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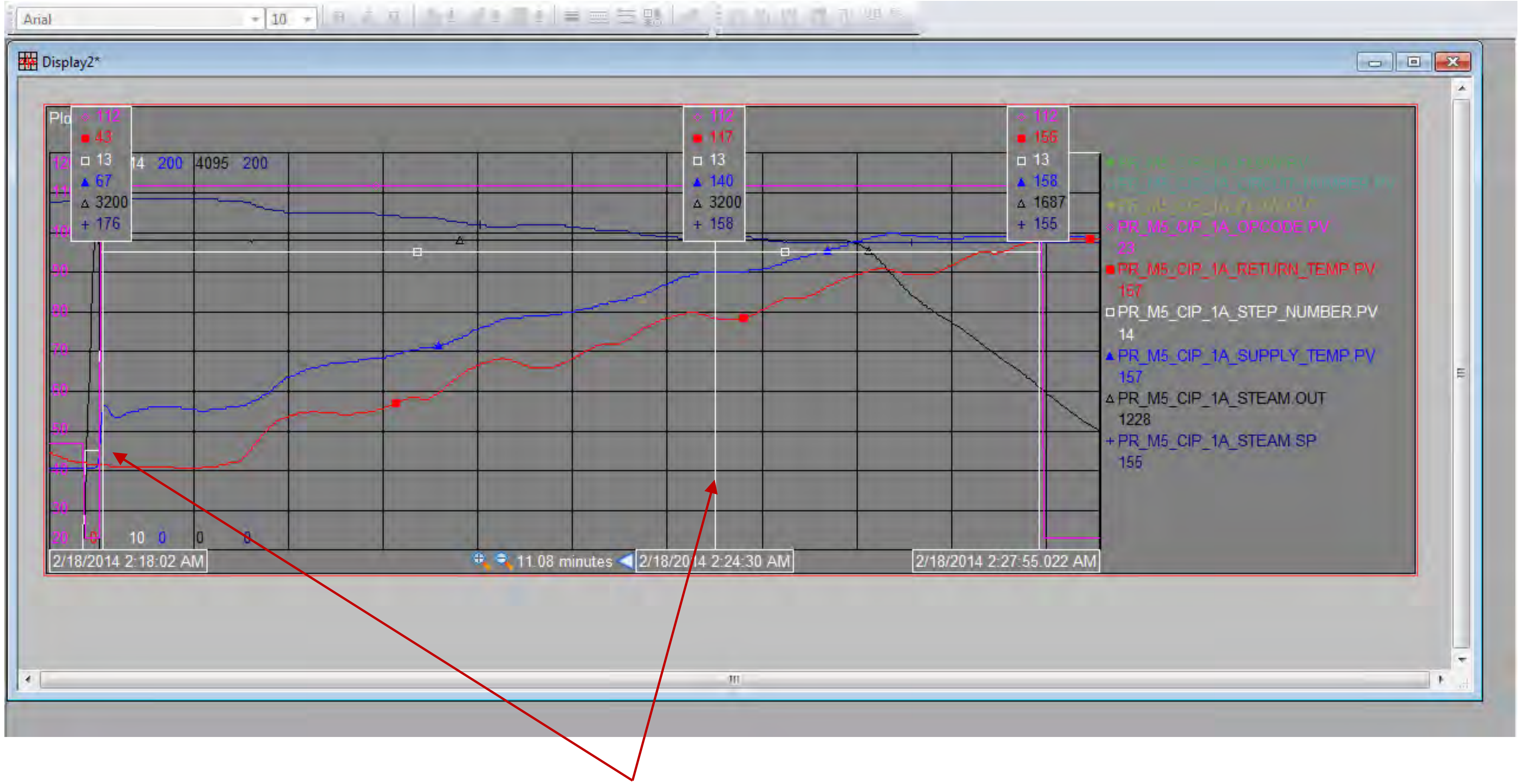
Common CIP Related Opportunities

Common CIP Programs:	Single Program used for multiple items (normally tanks)
	No individuality.
Items programmed to worse case scenarios:	Circuit might need 100 gallons to clean but uses 200 gallons…just so it does not run out of water.
Line Circuit Programming:	Commonly a huge waste opportunity as most programmers just do not understand what the true goal is but are just told to “do this”
Utility Control Parameters:	Steam and Water Heating Issues (example on follow page)

Delay To Temperature Issue



Due to programming "clamp" on the steam control this circuit took an extra 10 minutes to heat up "shown in first brackets"

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The "Verification Process"

Data is the key!

- Can you optimize without data….yes….but the required time difference between manual data collection and automated data collection is significant.

Evaluate the data!

- Digest the issue chart provided by the operators. Correct the mechanical/electrical issues first.

Understand the circuit!

- Tank circuits are very simple and straight forward. Water goes in, water comes out.
- Line circuits can be very simple by design or can be very complex especially if outfitted with mix-proof valves.
- In either case you must physically walk thru the circuit and follow the water.

Possible Optimization Options

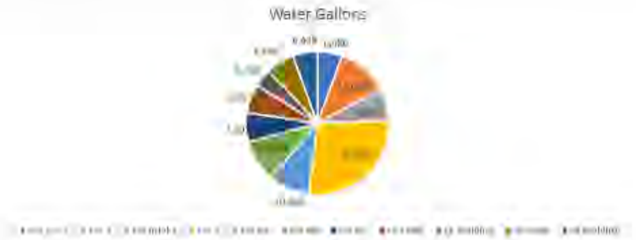
- Burst rinsing on tanks. Rinse-Drain-Rinse-Drain-Rinse-Drain…instead of one long rinse step. Most soils “float”.
- Faster valve pulsing routines for rinse steps only. **Follow the water** thru the circuit for the maximum soil removal. Normal pulsing after rinse steps have removed gross soils. Faster routines could also be used during heating steps to decrease delay to temperature steps.
- Match chemical delivery to valve pulsing and circuit volumes to prevent “dead” slugs of water rotating around the system.

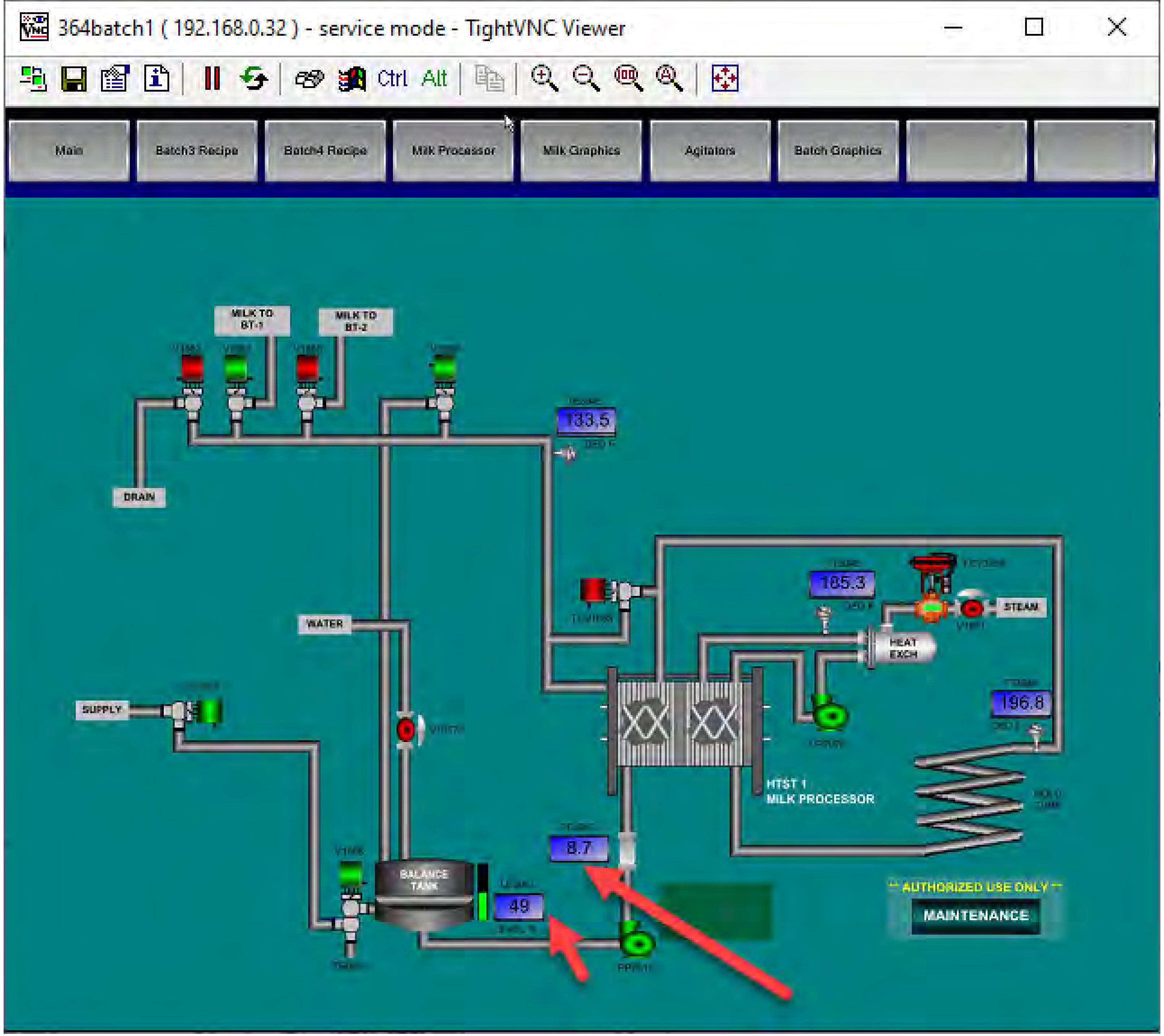
Sanitizer Delivery – Cost Controls

- Sanitizer delivery is usually the most difficult things to accomplish considering that one CIP might have circuits with significantly different flow rates
- We have worked with suppliers of flow-based pumps in order to apply the sanitizer compounds in direction relation to the system flow meter rates. This allows for the sanitizer delivery to keep up pace with the CIP supply flow. The best we have found is Grundfos.
- In doing so the sanitizer application times (and subsequently costs) can normally be dropped by 20-30%. Sanitizer normally is the highest cost per unit product used in a factory cleaning program.

Todays Tech - Remote Troubleshooting

Line Served	System ID	Flow	Supply Temp	Supply Pressure	Supply Cond	Return Temp	Return Cond	CIP Active	Circuit Name Running	Current Step Running	Current Step Number	Setpoint	Elapased Time	Step Time Remaining	Water Gallons	Total Circuits	Gallon Of Water Per Circuit	GraphStatus
Lines 1-2-3	CIP 1-2-3	0.3	56.2	-0.6	37.0	71.6	16.0	0	-		0	0	0	0	6,480	12	540	0
Line 4	CIP 4	58.6	73.2	1.4	-2499.5	68.6	-36.0	0			0	0	0	0	13,098	9	1455	0
Intake CIP	CIP Intake	0.0	122.0	0.0	15.2	78.4	50.0	0	-		0	0	0	0	8,624	19	454	0
Line 5	CIP 5	-0.1	73.4	-0.5	4.0	71.4	4.0	0	-		0	0	0	0	31,815	19	1674	0
Line 6A	CIP 6A	0.3	73.6	0.8	48.0	87.9	7.0	1	6A SPress Line to LM1 - Wash Only	Drain to Sewer	4	60	48	12	10,820	9	1202	0
Line 6B	CIP 6B	0.0	66.1	1.0	48.0	81.1	5.0	0	-		0	0	0	0	10,899	10	1090	0
Line 6C	CIP 6C	-0.1	66.2	1.5	49.0	79.4	5.0	0	-		0	0	0	0	7,601	9	845	0
L5 Latte	L5 Latte	0.0			1.0	41.0	9.0	0							7,525			
L5 Scalding	L5 Scalding	0.0			4.0	139.0	541.0	0							4,750			
L6 Latte	L6 Latte	0.0			14.0	47.0	0.0	0							7,393			
L6 Scalding	L6 Scalding	0.0			0.0	123.0	0.0	0							6,428			
															115,434			





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Basics – The Devil IS In The Details

You must understand the basics of the CIP process.

You must have an understanding of each circuit before you just make a change to make a change.

Granular details are critical.

Ask questions if you do not know. There are some good CIP SME's and experts that you can still ask.

It is **wise** to have someone who really understands process and CIP on your design team