3 GPH Line Leak Detector Requirement
Old Issues
Still Around & Evolving

Solenoid Valve Placement & Diesel Satellite Lines

Cycling Issues & Manifolded Piping Systems

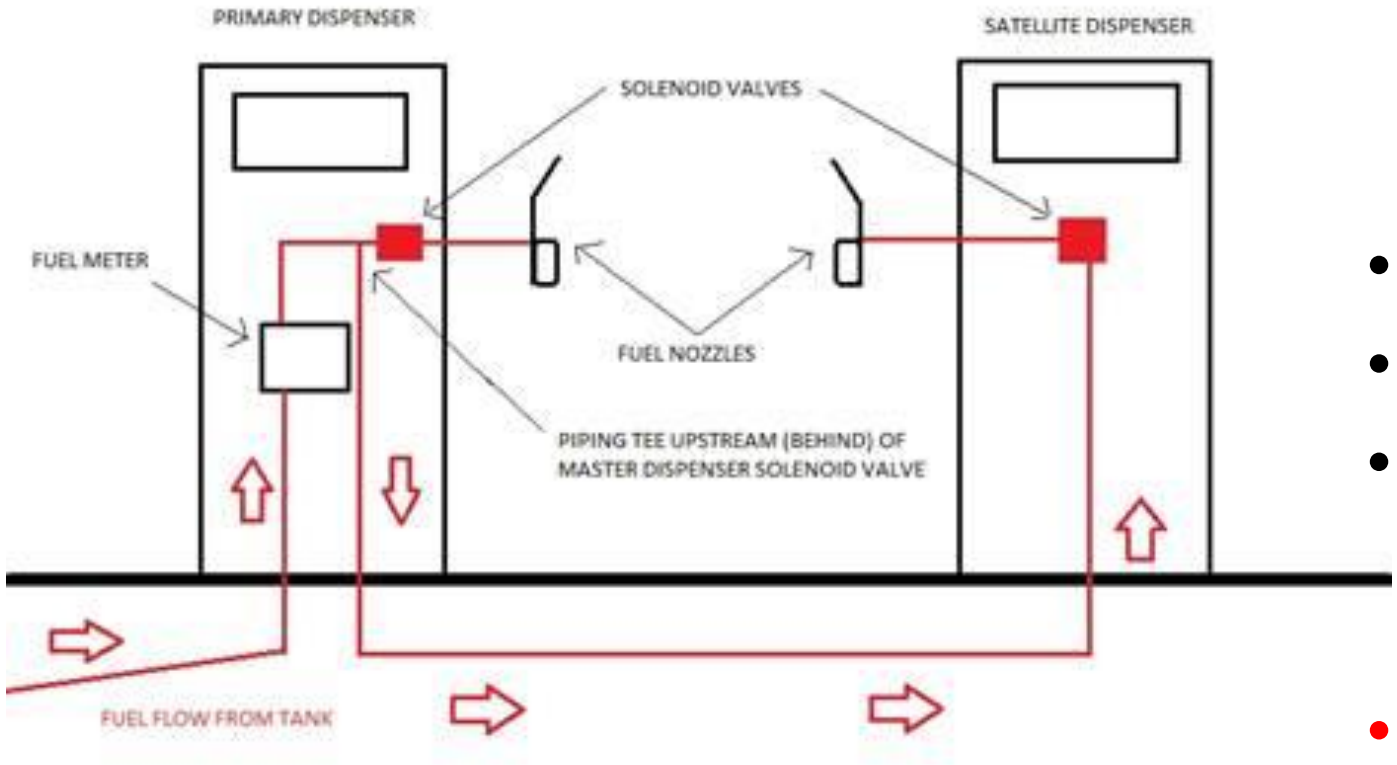
Other Odd LLD Related Issues

Wesley McCain, PE

MS Department of Environmental Quality

You know how it should be… but don’t take it for granted.

Satellite Lines
How it should be:



- STP cycles on
- LLD checks pressure in the pipe
- Leak present:
  - "Slow Flow" – Mechanical
  - "Alarm and/or Shut down" – Electronic
- If no leak: STP opens to full flow.
- Authorization by store clerk
- Solenoid Valves open allowing customer to fill

- Requires full unrestricted access for buried piping

Improper placement of solenoid valves will prevent the LLD from monitoring satellite lines.

Why are these issues commonly missed?

Solenoid Valve Placement & Diesel Satellite Lines

In Appropriate Testing

- LLDs should be tested from furthest diesel satellite line (PEI RP -1200)
- Is this commonly done? NO.
- It is easier for testers to connect to main line where they are able to cycle on / off STP easier.

Testers Believe it is right

- Even if previously cited by AHJ
- If contractor does not understand what the issue is… what happens?
- Connecting back up to same main line.
- Testing same way
- Passing results.

Understand Common Signs of the issue

(Regulators / Contractors)

- It is not rocket science
- It is simply knowing:
  - Where to look
  - What to look for
  - Confirm the issue

- Enforcement Staff recognizing that:
  - A simple retest won't suffice
  - A modification is necessary
  - Confirmation that modification was made

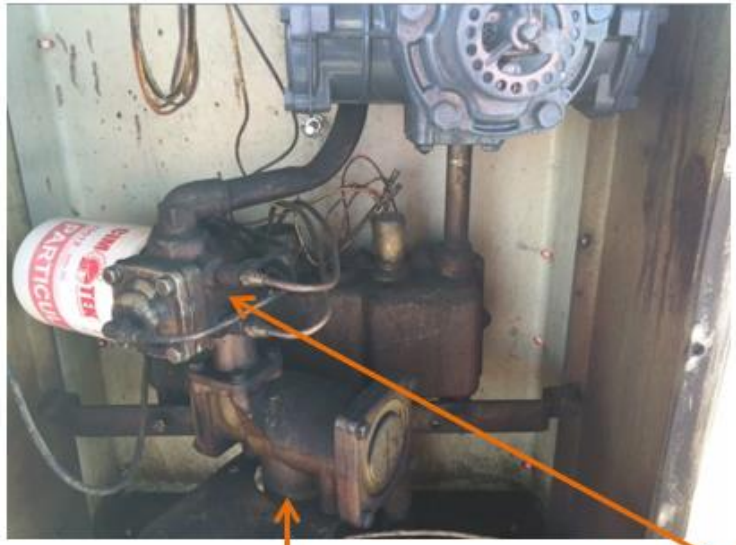
Know your Valves

The Bypass - Common Sign of the Issue

Satellite line plumbed
outside of dispenser.
100% definite sign of issue.

Different Dispenser… same bypass

Satellite line plumbed
outside of dispenser.
100% definite sign of issue.



Diesel Main

Valve

Main
(Nozzle)

No valve on Satellite – Common Sign of Issue

- Even if it had a valve
- Does that mean it’s okay?

- Depends on how it’s connected at Main.
- Follow the flow

No Satellite Dispenser – Common Sign of Issue

- Same premise.
- No Dispenser.
- No solenoid valve.
- Definite sign of issue.

Issue not limited to truck diesel configurations.

- If you see a satellite line coming from a typical gas dispenser
- There is a strong chance it is wrong.

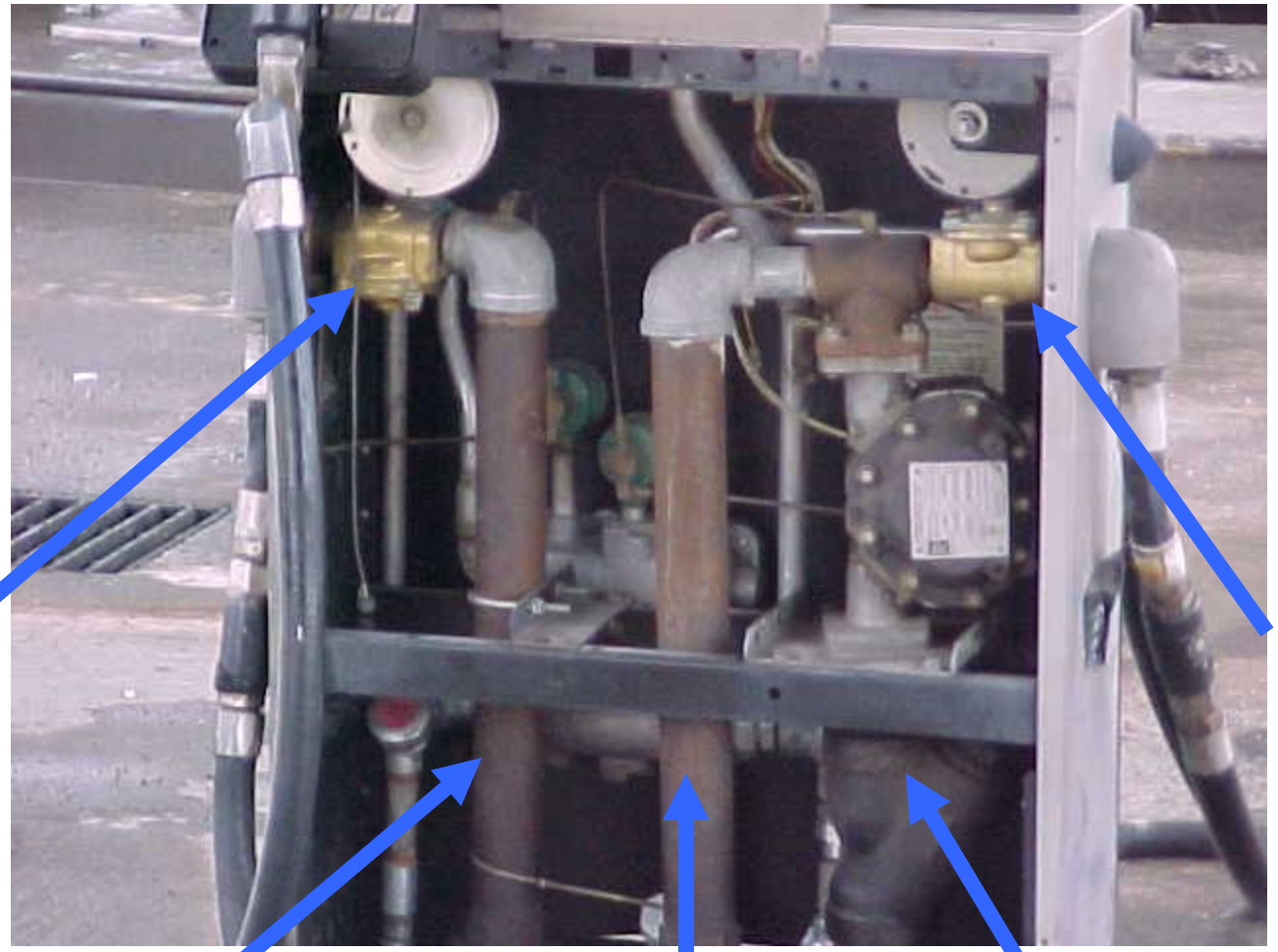
- Do not rely on the satellite dispenser having a valve.
- Follow the flow and verify.

Gas Dispenser plumbed with Satellite Line

(Smart Idea but failure on implementation)

Don’t take it for granted…..
Cleveland, MS – 2025
Where is the solenoid on the sat?

Follow the flow & solenoid valve placement



Will this work?

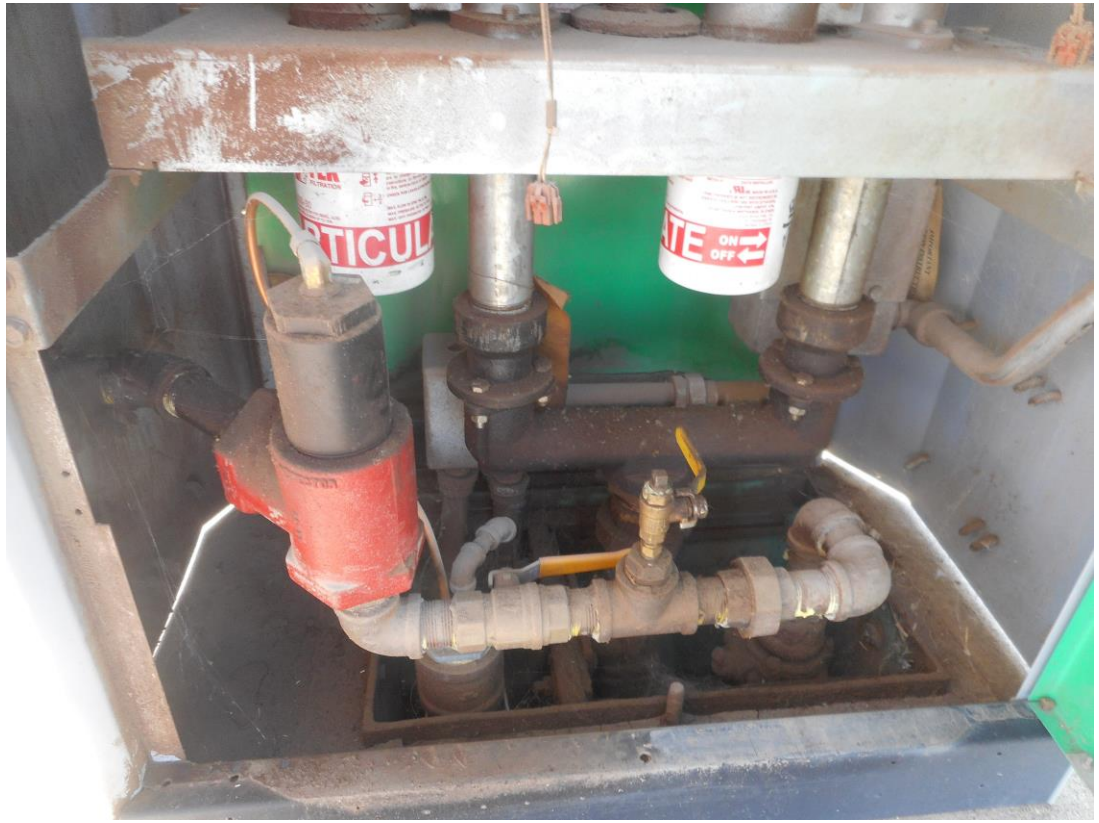


Image: Credits to Idaho Dept of Environmental Quality

- Mechanical installed on satellite line.
- Restricts flow on satellite line only.

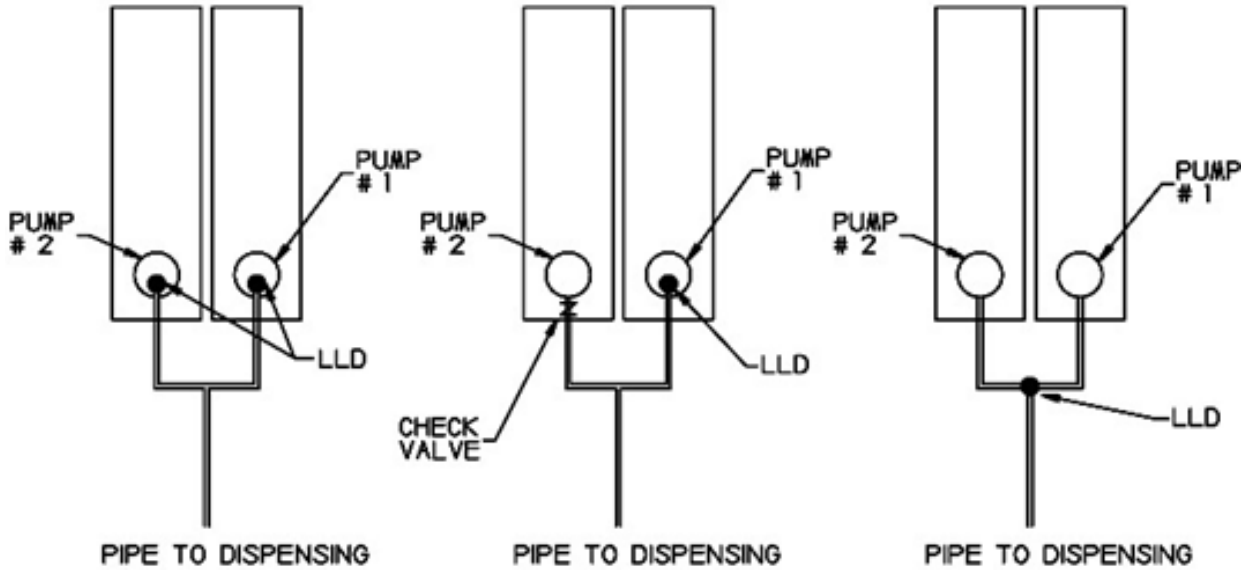
- Issues:
  - Would the customer notice the slow flow?

    Likely Not.
  - Where does the mechanical drain line go?

    Usually nowhere good.
  - Would it work for electronic LLD?

    Yes.

Traditional pipe manifolds



- **Primary concern:**

  LLD not being capable of seeing a 3 gph leak in the product line.

- **Mechanical LLDs:**

  Detectable Leak Rate is cumulative.

  3gph per each STP that cycles on simultaneously. (cycling matters)

- **Issue has evolved with time.**

Traditional Pipe Manifolds

Mechanical here will not catch a leak in the two pipes prior to the manifold.

Will it work here?

Depends on equipment and setup.

Jerry-Rigged Pipe Manifolds
(at dispensers)

- Common at older facilities needing more storage.
- Dispenser change outs.

- Tanks previously stored regular, plus, and premium.

- Will it work here?

  Depends on the equipment and setup.

  (It's not likely.... As these were after thoughts.)

Hidden Manifolds

- If something does not make sense with:
  - Fuel stored in the tanks.
  - The number of STPs per grade of fuel.
  - Piping layout and Nozzles at dispensers.

- Further investigation is needed.
- Look closely
- Check equipment present.

- Will it work here?

  Still, Depends on the equipment and setup.
  (Still not likely…. As these were after thoughts.)

Why are these issues commonly missed?

Cycling issues with Manifolded Piping

In Appropriate Testing

- LLDs should be tested on an “as found” basis.
- Are they?
- Not if contractor has to:
  - Turn off breakers
  - Flip ball valves to isolate lines.
  - Adjust switches on smart control box
  - Make any kind of adjustment to how the STPs “cycle” ON prior to testing.

Testers Believe it is right

- Even if previously cited by AHJ
- If contractor does not understand what the issue is… what happens?
- Retesting same way
- Passing results.

Signs of cycling Issue.
Traditional Way to Tell

- Energize product line at the dispenser.

  (remove nozzle / lift handle)

  Without authorization from clerk or selection of grade.

  Why?

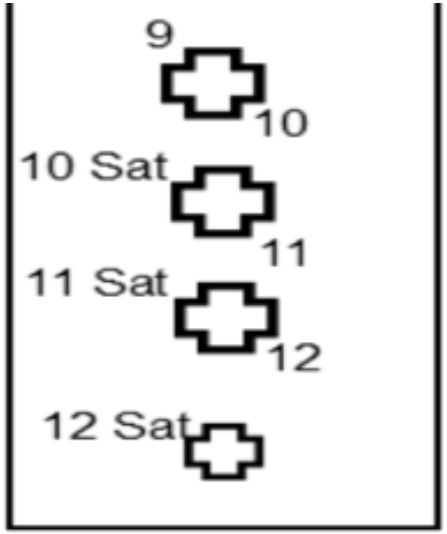
- If only 1 STP cycles "ON" and the other **does not** come "ON" your likely okay.
  - Repeat, to determine which STP feeds which dispenser.
  - Repeat, to determine which STP is the master.
- If multiple STPs cycle "ON" there is a problem.

Traditional way will not always work. Batesville, MS – 2025

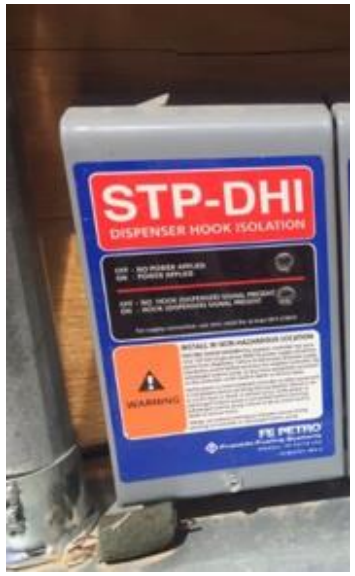
- Issue was disguised by method of pipe release detection in use for years.
- Both STPs cycle ON separately.

- Sign of issue:
  - Annual Line Tightness Test indicates 1 pipe.
  - What prevents the other STP from cycling on?
- Is this okay? No.

**This is likely much more common than we think.

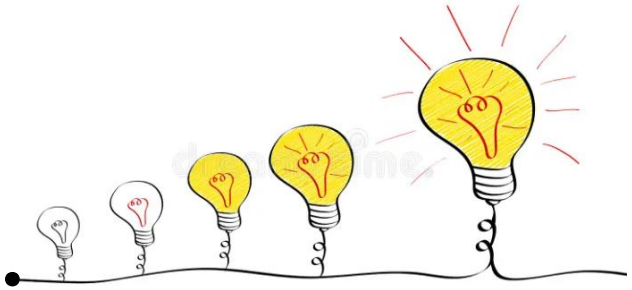


Recognize what does not work.



- Using dispenser hook signal isolation boxes *or* contact relay boxes alone will not work.
- If there is a manifold, something has to control cycling. What is it?
- If no additional box, control, is present there likely is an issue.

Rolling with Evolution
Additional checks are needed…



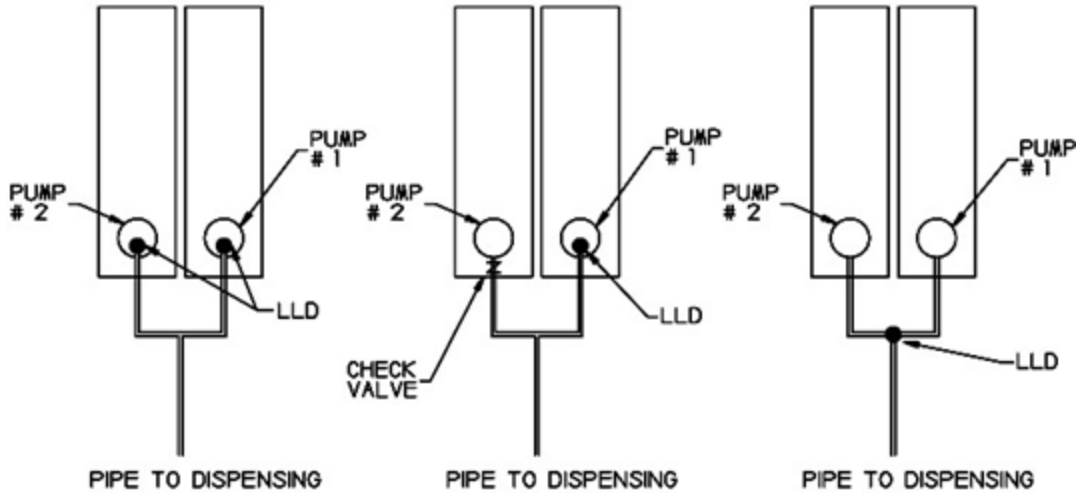
Verify that the site has the necessary equipment to work

What works?

- Smart control boxes to cycle the STPs.
- Mag Variable Frequency controller

Function is STILL dependent upon adequate setup….

How does it work? Is it confirmed?



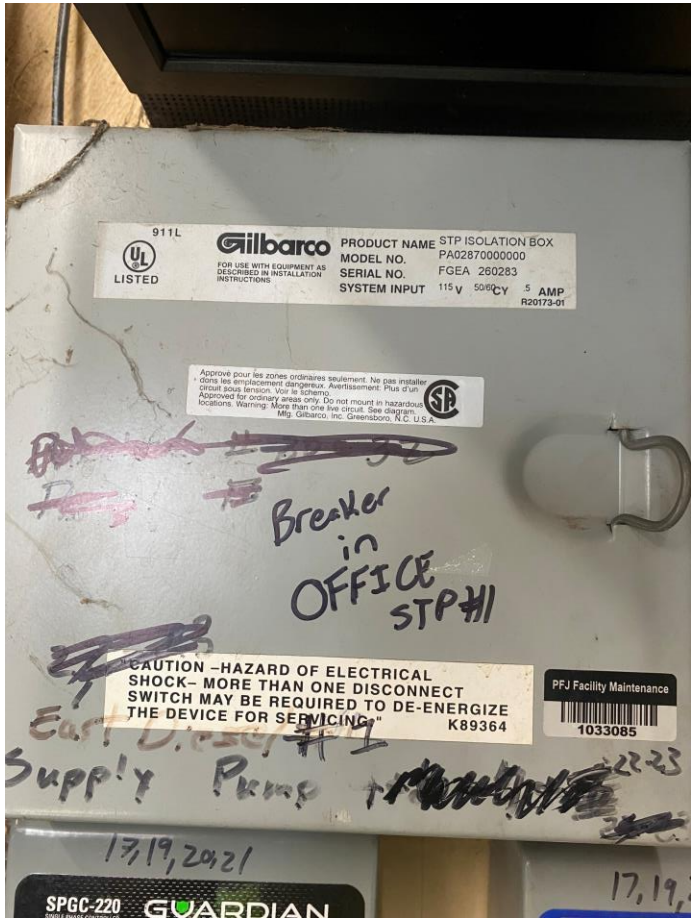
- Controllers typically notice a difference in power consumption of the STP that is in slow flow condition.
- Prevents other STPs from cycling ON.

- This should be confirmed during routine testing. Is it?
  - Handle should be raised at multiple dispensers.
  - Verify that LLD remains in slow flow.

It still may not cycle right….

- Just because it “tested” good at the time of last test does not mean that it’s good today…
- Dip switch positions determine how the STPs cycle ON / OFF. Easily changed.
- Watch the boxes for a period of time and how they cycle.
- Boxes usually have lights.
- Familiarize yourself with manufacturer manuals

Tip: Follow the Signs & Labeling

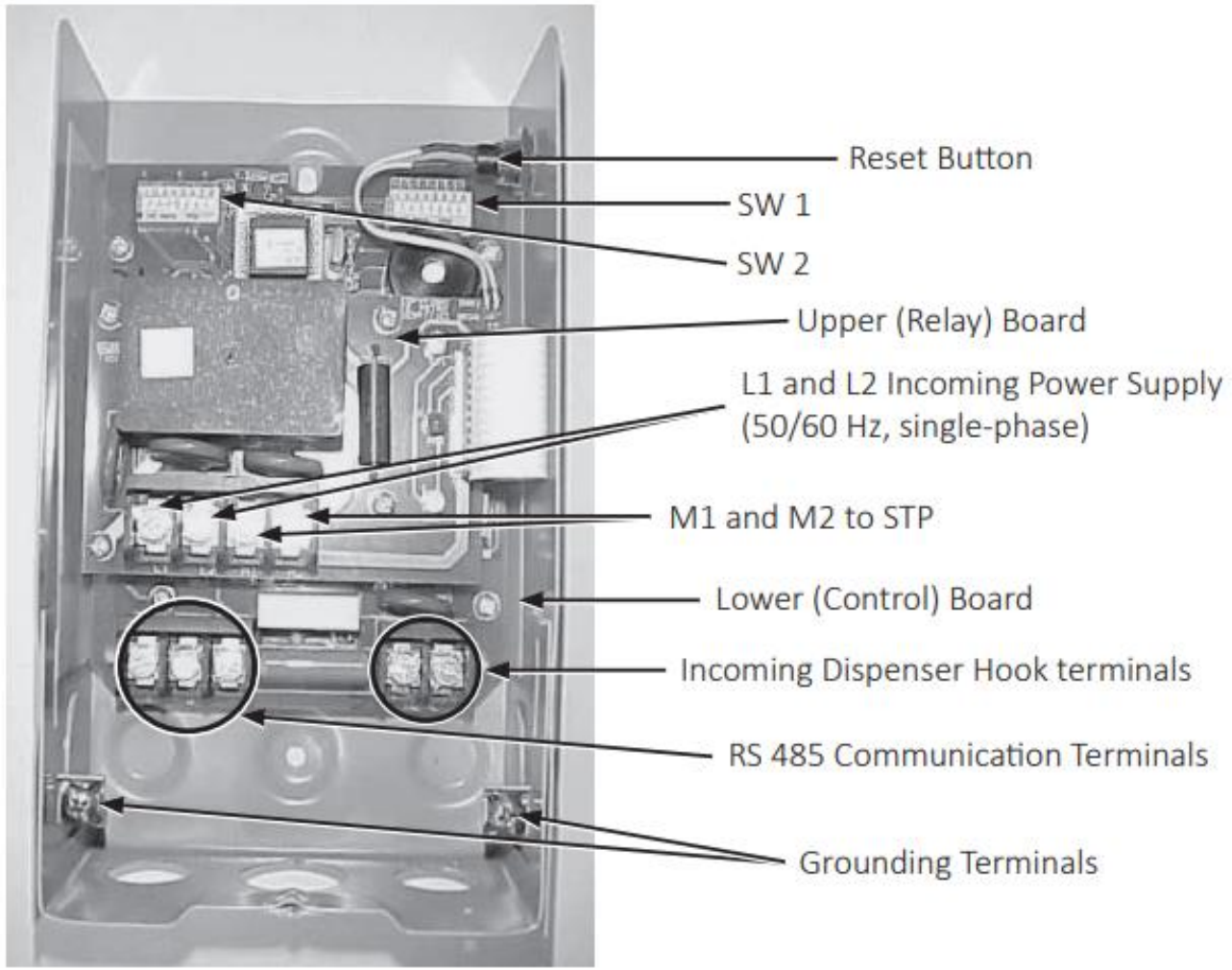


Emerging Issue & Concern

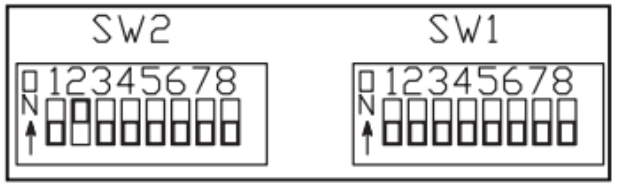
It is no secret… that a flip of a switch and slow flow issue goes away.

Some contractors do this unknowingly.

Some… it is intentional.

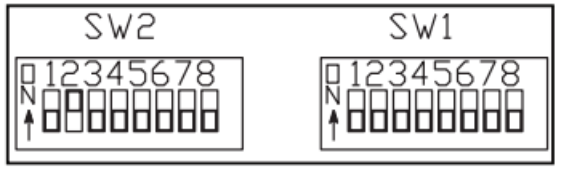


Example Switch Settings



SW 2			SW 1		
Pole	**Description**	**Function**	**Pole**	**Description**	**Function**
1	Fault Shutdown	When this is ON, an abnormal condition detected on any controller in a Master-Slave or AC configuration causes all connected controllers to shut down.	1	Address 0	Use poles 1-5 to set the addressing switches for Master-Slave or AC configurations. See step 4 of the "Master-Slave/AC" section.
2	Unused	The default position is ON.	2	Address 1	
3	Master-Slave*	ON designates the STP-SCI as the master controller. This switch must be set to OFF for Slave and Stand Alone configurations.	3	Address 2	
4	AC**	When the master controller is ON, the AC feature is active. OFF indicates a Slave or Stand Alone configuration.	4	Address 3	
5	Extended Run Disable***	ON disables the extended run feature. OFF activates the extended run feature.	5	Address 4	
6	Unused	Unused switches	6	**Fault Read out***	ON activates the fault readout function.
7	Unused		7	**Bypass***	ON bypasses diagnostics for 10 minutes.
8	Unused		8	**Auto Restart*****	When ON, the controller tries to restart the STP in an underload (1 flash) error when a hook signal is applied.

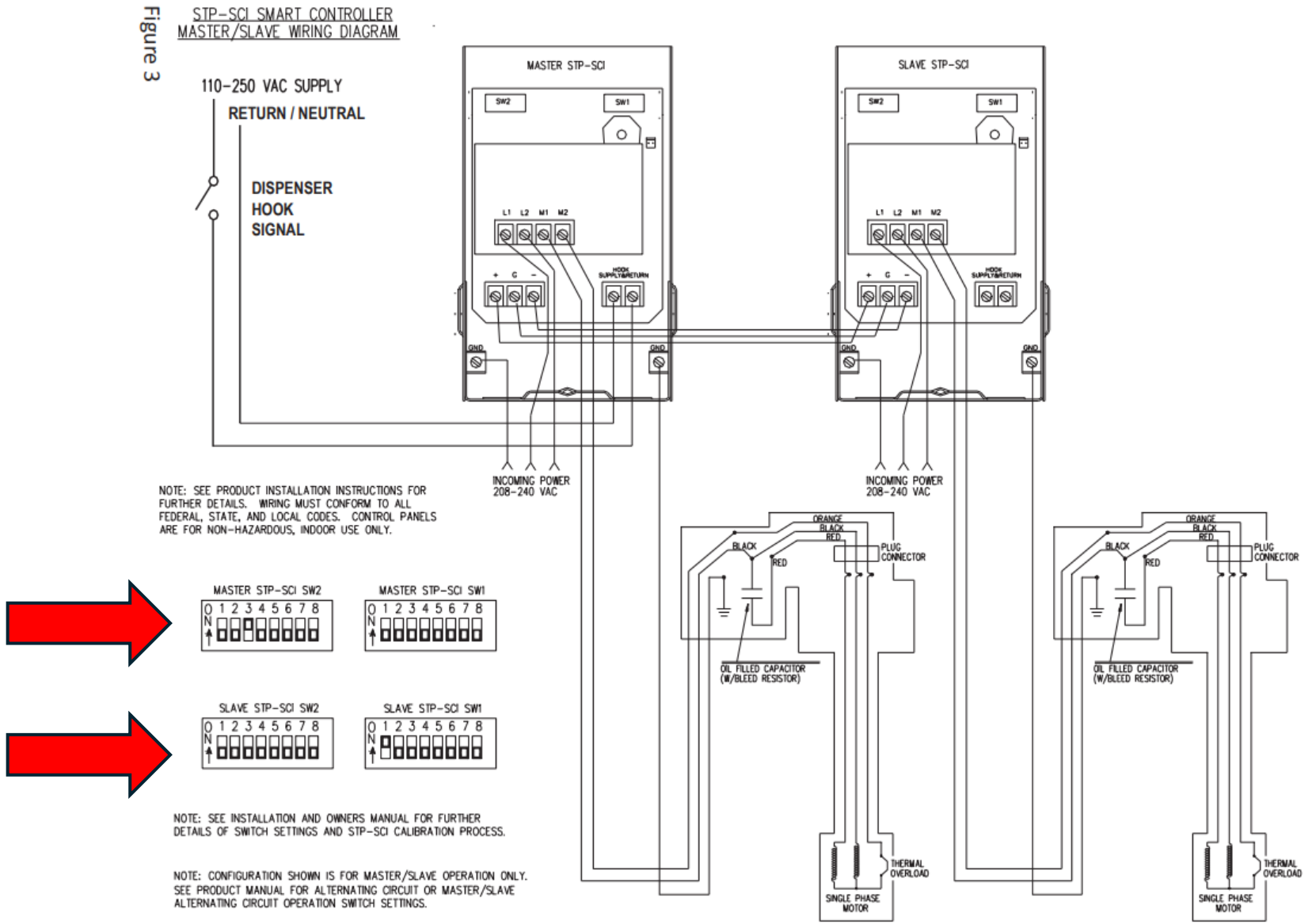
Example switch settings



	SW1				
Address	Pole 1	Pole 2	Pole 3	Pole 4	Pole 5
Master	Off	Off	Off	Off	Off
Slave - 1	On	Off	Off	Off	Off
Slave - 2	Off	On	Off	Off	Off
Slave - 3	On	On	Off	Off	Off
Slave - 4	Off	Off	On	Off	Off
Slave - 5	On	Off	On	Off	Off
Slave - 6	Off	On	On	Off	Off
Slave - 7	On	On	On	Off	Off
Slave - 8	Off	Off	Off	On	Off
Slave - 9	On	Off	Off	On	Off
Slave - 10	Off	On	Off	On	Off
Slave - 11	On	On	Off	On	Off
Slave - 12	Off	Off	On	On	Off
Slave - 13	On	Off	On	On	Off
Slave - 14	Off	On	On	On	Off
Slave - 15	On	On	On	On	Off
Slave - 16	Off	Off	Off	Off	On
Slave - 17	On	Off	Off	Off	On
Slave - 18	Off	On	Off	Off	On
Slave - 19	On	On	Off	Off	On
Slave - 20	Off	Off	On	Off	On

Reference Installation Manuals.

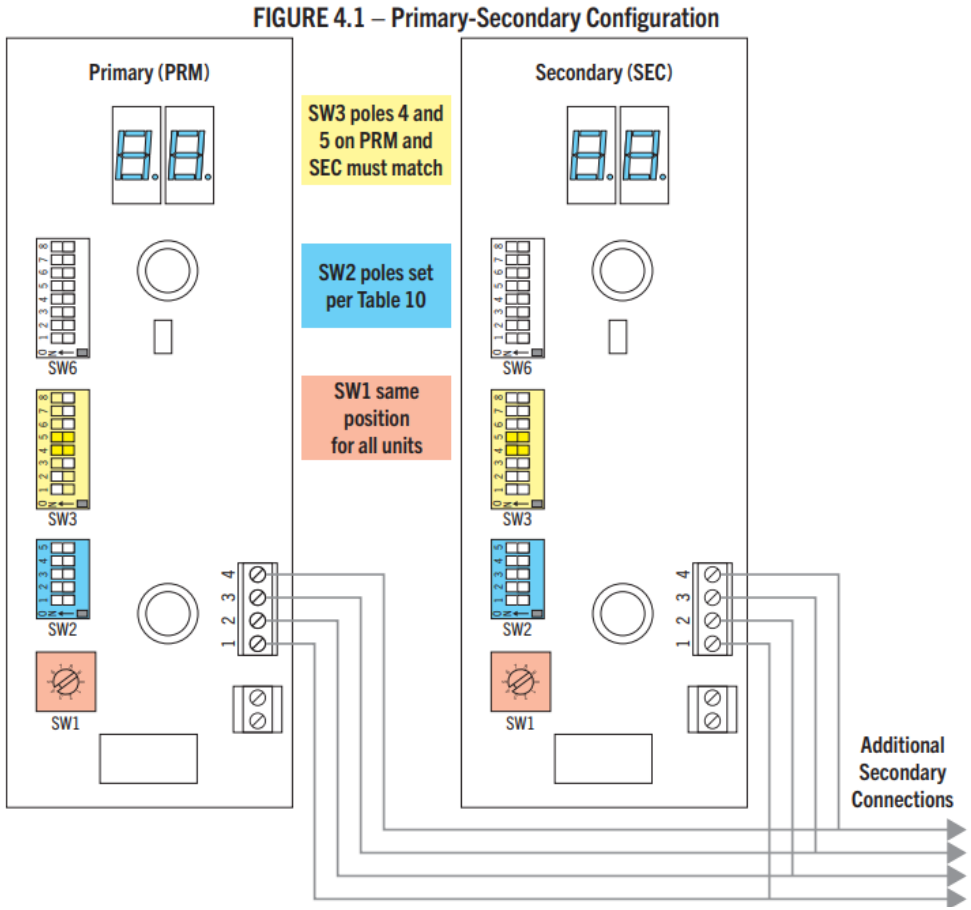
https://nationalpetroleum.net/docs/223987101-r6-smart-controller-i-installation-guide.pdf



Mag Variable Frequency Controllers

- Similar capabilities.
- Flip of a switch.

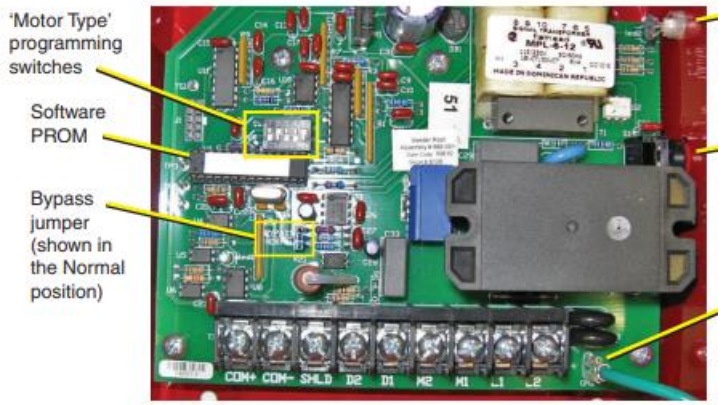
- Reference manufacturer installation manuals.



Veeder-Root IQ Control Box

Similar capabilities.

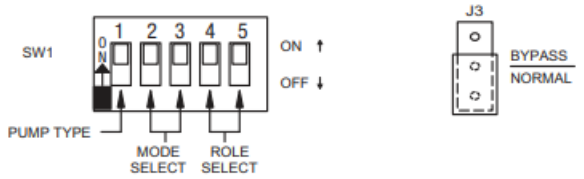
Flip of a switch.



Each IQ Box must have its duty established through the dip switch bank labeled SW1 on the circuit board.

Follow the chart below to properly set each of the five switches.

Pump Type	Switch 1	Mode Select	Switch 2	Switch 3	Role Select	Switch 4	Switch 5
Standard	on	Stand Alone	on	on	Uint 1	on	on
X Series	off	Manifolded PLLD	on	off	Unit 2	on	off
		Manifolded Alternating	off	on	Unit 3	off	on
		Manifolded Direct	off	off	Unit 4	off	off



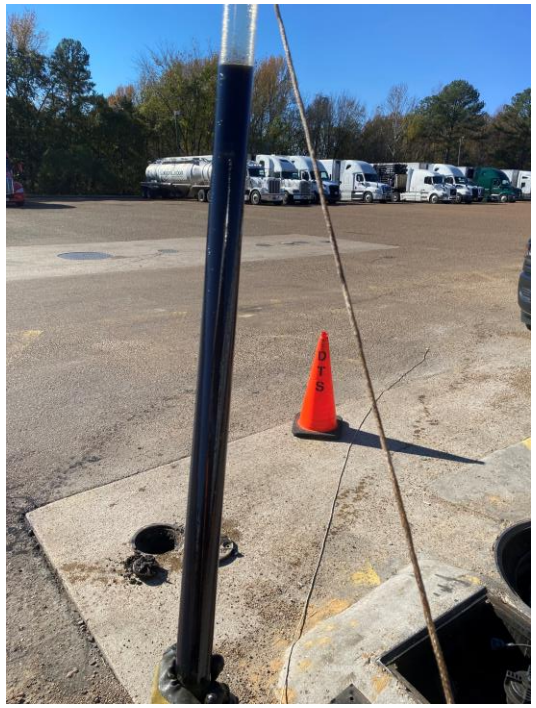
At what point should a regulator check?

- Significant leak?
- Death or other personal injury?
- Investigation of contractor violation?

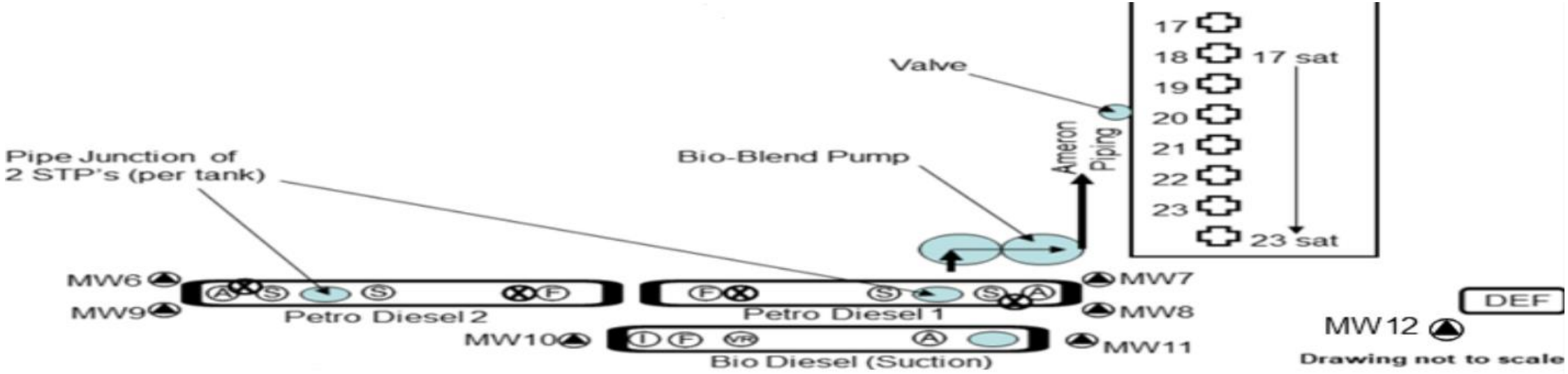
<u>Recommendation:</u>

- Discuss with your supervisor.
- If contractor is on site, ask them to show you.
- Don’t touch it.

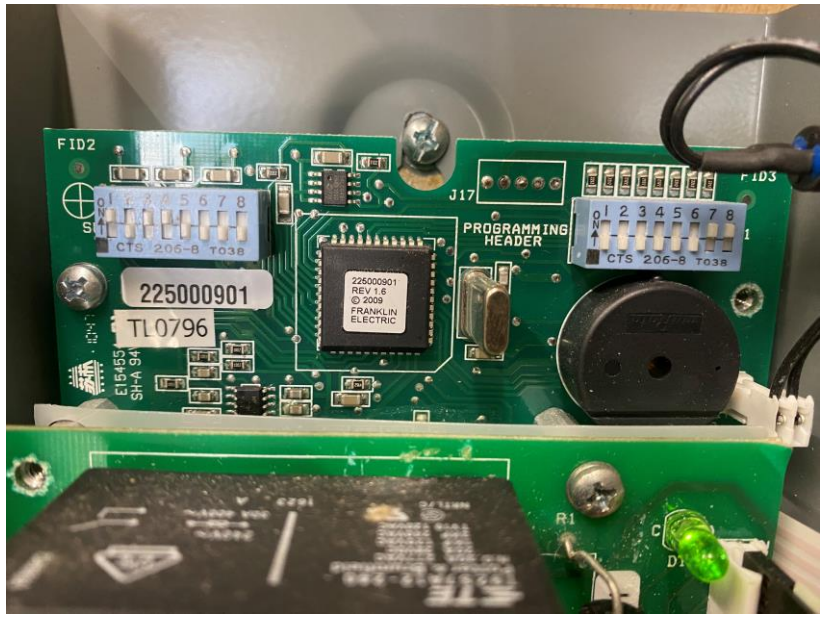
Don’t take it for granted…
Winona, MS – 2023 pipe leak

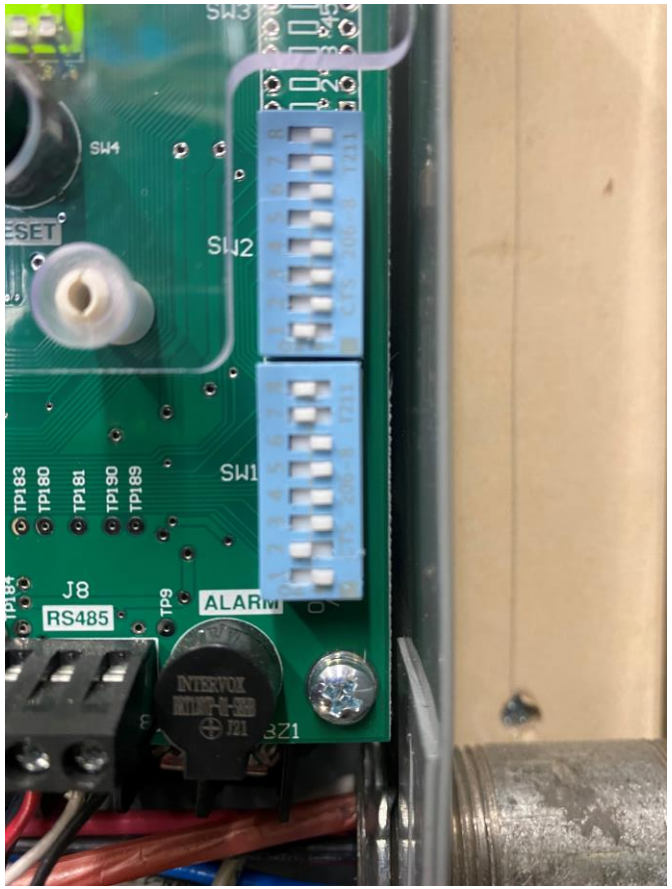


- MW7 – full of diesel > 89 inches.
  - LLD cycling issues were confirmed prior to release? Yes.
  - Were they fixed prior to release? Yes.
  - Unclear, if cycling issues were present at time of release.
  - LLD cycling issues were confirmed to be present after release & repair made to pipe? Yes.
- What happened and why is it so hard to get this right?



Example Evidence
Necessary to collect at time of discovery.





Don’t let your enforcement be “he said / she said”. Collect the evidence!!!

Remember….
LLD tests should be performed under “Normal” operating conditions.

- STPs should cycle On/off as they normally do.

- At no time should tester have to:
  - Shut off a ball valves to isolate lines
  - Adjust settings / switches on smart control boxes
  - Make any kind of adjustment to how the STPs normally “cycle” ON prior to testing.

When in doubt… Mr. Contractor show me….

- If there is ever a discrepancy
  For any test result or equipment
- Have contractor reperform test in presence of AHJ.
- That is the only way to verify results and that adequate procedure is followed.
- Use it as a learning tool.

Other Odd LLD related Issues….

Test location matters.

- Simulated 3 gph leak rate should be done where?

  Furthest point in the line.

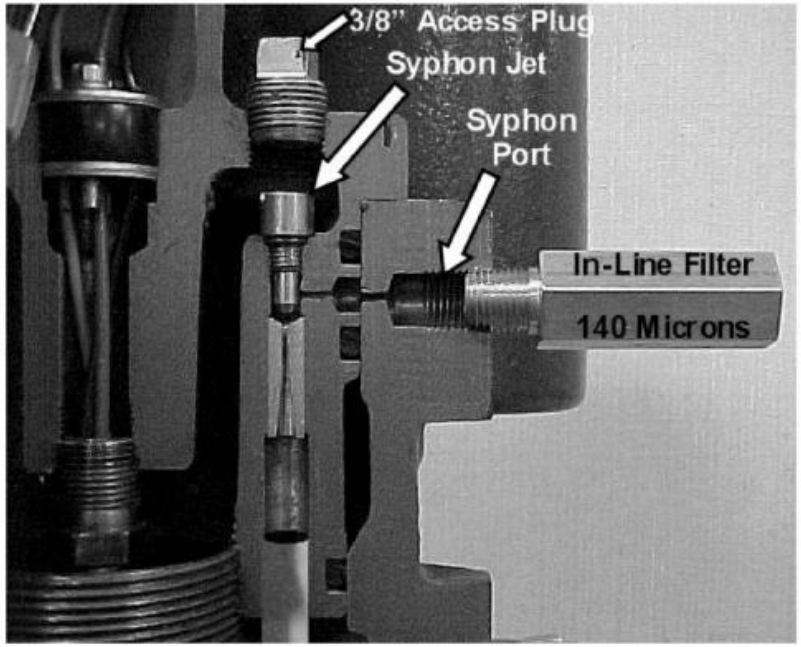
- Why?

  Used to be highest point.

  Eliminate trapped air.

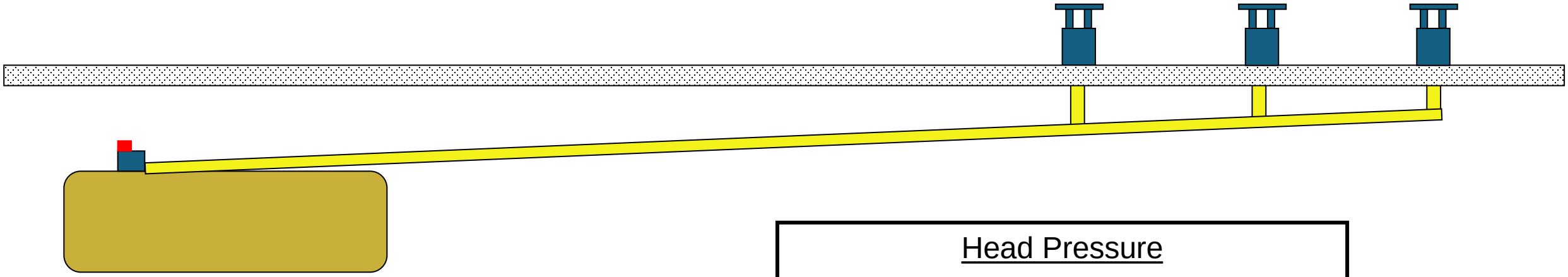
  Demonstrate that LR is detectable throughout the entire pipe run. (head pressure in line)

- Is your form setup to document test location?
- Does it matter? Yes.



Syphon Jet: Notorious issue of injecting air into lines.

- Some mechanical ALLDs will not “trip” unless line pressure drops to 1-5 psi
- Not all piping is sloped back to the tank.
- Test must confirm that ALLD will “trip” under static head conditions at the facility
- Testing should be done at furthest dispenser.



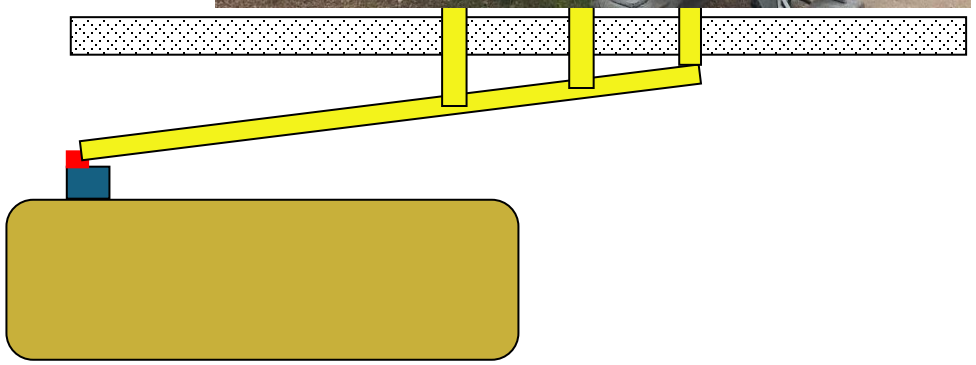
Head Pressure

38 inches of gasoline = 1 psi

Mechanical LLDs - Bulk Rack Applications

**Piping slopped uphill.

Head Pressure
38 inches of gasoline = 1 psi
5 feet = 1.56 psi
10 feet = 3.12 psi
15 feet = 4.68 psi



The column of fuel in the rack would need to drop potentially 10 feet to relieve the static head pressure in the line.

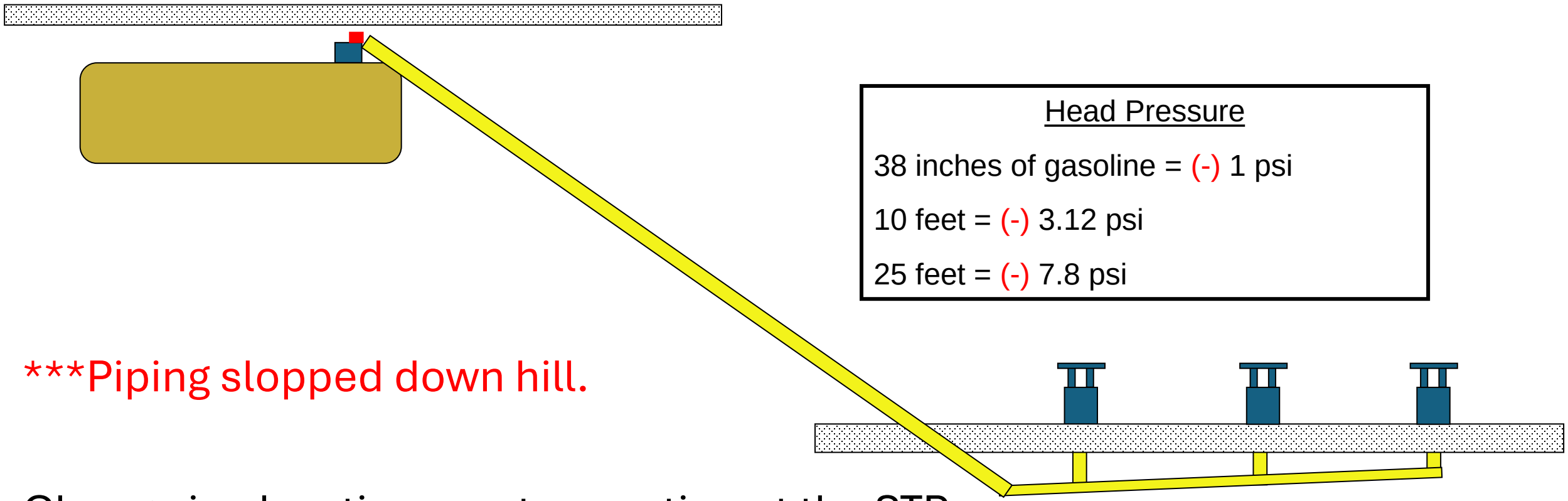
(10 feet of 1.5 inch diameter pipe = approx. 1 gallon of fuel)

Detectable LR is much higher than equivalent 3 gph @ 10 psi orifice size.

Solutions:

- Check valve must be installed to separate head pressure.
- Mechanical LLD with higher “tripping pressure”.
- Electronic PLLDs

Mechanical LLDs –Marina Applications



Head Pressure
38 inches of gasoline = (-) 1 psi
10 feet = (-) 3.12 psi
25 feet = (-) 7.8 psi

***Piping slopped down hill.

Change in elevation creates suction at the STP.

- Mechanical LLD will go into slow flow easily.
- Issue is: Suction will empty the tank in the event of a leak.
- Anti Syphon / Solenoid Valve needed at STP.

Other Odd LLD related Issues….

What does alert mean to you?

Automatic line leak detectors. Methods which alert the operator to the presence of a leak by restricting or shutting off the flow of regulated substances through piping or triggering an audible or visual alarm may be used only if they detect leaks of 3 gallons per hour at 10 pounds per square inch line pressure within 1 hour. Testing must be performed in accordance with the following requirements:

- Alert – restriction to end use equipment.

  Dispenser ---- immediately noticeable.

- Was this the intent of initial UST regulations?
- Do mechanical LLDs installed in pressurized blending applications meet the original intent?
  - Not if it does not restrict to end use equipment (dispenser).
  - Simple inventory / mixing rate issues alone is not sufficient.

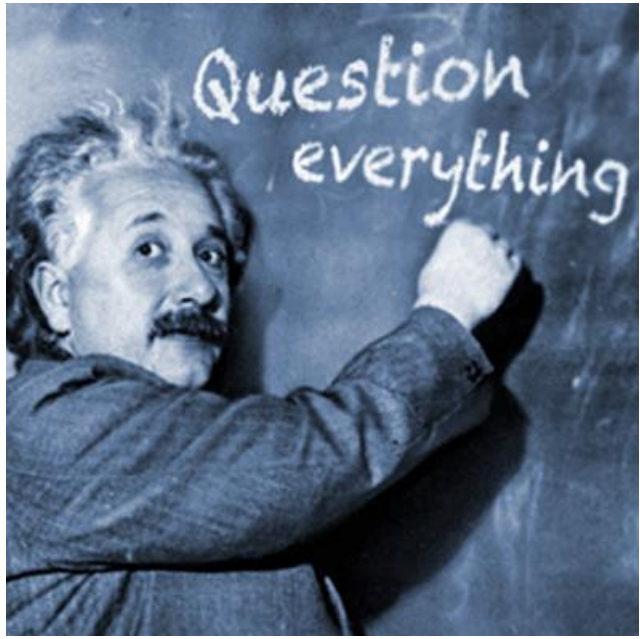
  (MS C&E Enforcement opinion)

Words of advice to inspectors…

Wesley McCain, PE.

662-832-7106

wmccain@mdeq.ms.gov



If you guys don’t see it.. Who else will?

….find the big high-risk problems.