Chemical Injection Monitoring and Control

By Detechtion Technologies - October 23, 2018

Introduction

What is Chemical Injection?

Operators are constantly attempting to optimize production of their oil and gas wells. They can accomplish this by either stimulating flow and/or minimizing downtime. While downtime is usually associated with equipment failure or breakdown, there is an entire category of issues related to environmental conditions downhole that can lead to damage or blockage of the well and/or flowline, resulting in expensive workovers. Following are some examples:

- **Bacteria**: bacteria can grow inside the wellbore, which can plug up or corrode piping/equipment.
- **Corrosion**: if the fluid in the wellbore/flowline has high water content then the metal tubing in which the produced fluids flow can become compromised due to corrosion.
- **Paraffin**: wax deposits can occur in production tubing, reducing flow.
- **Hydrates**: these crystal/ice-like formations can block the production tubing.
- **Foam**: foam inhibits flow of hydrocarbons

An entire industry has grown out of the need to mitigate the above category of problems – Chemical Injection – wherein specialty chemicals are injected downhole to prevent the afore-mentioned issues. For onshore wells, the chemicals are either delivered as batch treatments via trucks, or by continuous dosing using on-site chemical tanks. In the latter case (and the focus of this paper), a chemical service company sells tanks and pumps to an operator and provides ongoing services to fill the tanks, set the pumps at the recommended rates and take periodic samples.

The amount of chemical that needs to be delivered is dependent on the specific category of chemical being used along with production volumes for oil, gas, and/or water. Some chemicals require knowledge of only one of these components, whereas some require two or all three. The chemical manufacturer specifies the parts-per-million (PPM) dosage requirements for each component, and the dosage rates are derived by applying the PPM factor(s) to the actual production. The pump is then set accordingly to achieve the target dosage.

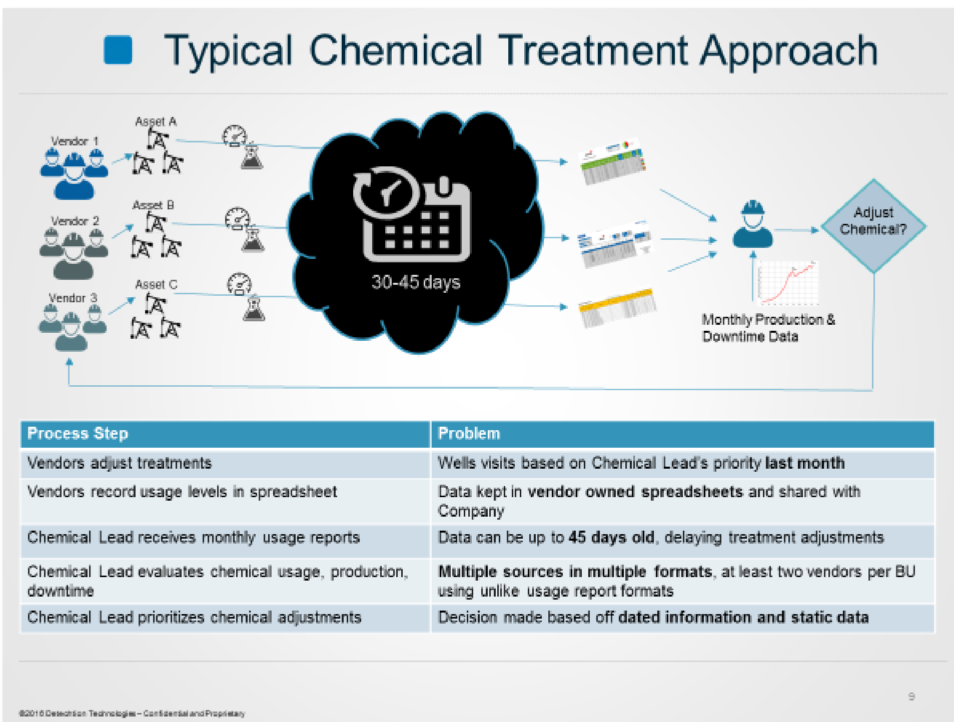
It is important to ensure that the proper amount of chemical is being delivered to its target. Under-dosing can result in damage to the wellbore that a given chemical is supposed to prevent. Over-dosing not only results in wasted chemical and needless cost, but depending on the chemical, can also lead to damage.

Problems with Current State

With potentially thousands of wells in any given basin, operators struggle to keep up with their chemical injection programs. They need to constantly adjust the rate of their pumps to change the total amount of chemical delivered per day based on various parameters, including:

- Varying production volumes (oil/gas/water)
- Varying downhole pressure
- Varying ambient temperature
- Varying properties/ratios of produced liquids and gases
- Varying properties of the reservoir/formation

One super-major has estimated that with an effective chemical injection program they have the potential to save $30,000 on average per well per year. Although they recognize the importance of managing their chemical programs, few operators monitor their onshore chemical tanks and pumps, and consequently have little to no visibility into what is happening at the well. They instead rely on the chemical companies to keep their tanks filled and to adjust the pumps. Figure 1 below illustrates the current state:



Process Step	Problem
Vendors adjust treatments	Wells visits based on Chemical Lead's priority **last month**
Vendors record usage levels in spreadsheet	Data kept in **vendor owned spreadsheets** and shared with Company
Chemical Lead receives monthly usage reports	Data can be up to **45 days old**, delaying treatment adjustments
Chemical Lead evaluates chemical usage, production, downtime	**Multiple sources in multiple formats**, at least two vendors per BU using unlike usage report formats
Chemical Lead prioritizes chemical adjustments	Decision made based off **dated information and static data**

Figure 1. Typical Chemical Treatment Approach

Solution

Automating the chemical tanks and pumps is the key to addressing the above issues. A properly managed chemical automation program includes the following elements:

- Inventory levels: knowledge of how much chemical is in a tank
- Target Dosage Rate (volume per unit of time) determination for each chemical type

- Flow assurance: knowledge that chemical is being delivered downhole at the proper dosage rate
- Actual Dosage Rate adjustments based on changing operating conditions to maintain Target Dosage Rates

This paper discusses options and strategies for implementing an automation system on chemical assets that delivers the afore-mentioned desired traits.

Determining Liquid Level

At the core of a chemical management program is the determination of the liquid level in the chemical tanks. The most basic benefit of this measurement is that it lets the proper personnel know when a tank needs to be refilled to ensure continued dosing of the well. As we shall see later, though, liquid level is also the key to enabling an affordable method for determining dosage rates versus expensive flow meters.

Challenges

Depending on the level sensing technology selected, several factors present challenges to obtaining accurate and consistent results:

- **Temperature variations**: Almost all sensors are vulnerable to ambient temperature fluctuations that affect either the measured fluid, the measurement process or the sensing element itself. Many sensors include a temperature sensor to implement compensation logic. *Temperature variations from daytime to nighttime represent one of the biggest challenges to obtaining accurate tank levels*.
- **Venting**: Several of the technologies listed above (e.g., ultrasonic and hydrostatic) require a properly vented tank to perform effectively. Many chemical tanks have a crude pressure relief valve in the lid that allows some pressure to build up inside the tank, adversely affecting the level readings.
- **Pump stroking**: The pump stroking action can affect the accuracy of the liquid level sensor. For example, if a hydrostatic pressure transducer is installed on the outlet piping of the tank it will result in a noisy signal due to changes in pressure as the velocity of the liquid in the pipe changes. Even if the transducer is submerged inside the tank it can pick up vibrations generated by the pump that travel through the tubing/piping and into the tank body.
- **Specific Gravity**: Several level sensing technologies (e.g., hydrostatic pressure and load cells) must account for the specific gravity/density of the chemical being measured. Chemical manufacturers usually provide a specific gravity range rather than an exact number. Additionally, the specific gravity changes as the temperature changes, adding further error to the liquid level calculation.
- **Tilted/leaning tank**: When tanks are installed at a wellsite they are rarely located on top of a flat concrete pad. Rather, they sit on metal legs on uneven ground. This results in the tank leaning to one side, making it difficult to know what the true level is. An additional challenge is that the amount of tilt can change depending on the amount of chemical in the tank, when it rains, or when the tank is potentially bumped during the fill process. Technicians also tend to lean the tanks toward the piping outlet in between fills so if the chemical level gets low there is still

enough liquid to clear the height between the bottom of the tank and the outlet pipe. And finally, when a Tech tries to calibrate a sensor by manually measuring with a tape they may not always be measuring from the same point.

- **Sediment**: Over time sediment can build up in the bottom of the tank, presenting a challenge for sensors that sit at the bottom of the tank such as hydrostatic pressure transducers.
- **Foaming**: Chemicals that tend to foam at the surface can present a challenge to sensors such as ultrasonic that use liquid surface reflections to measure distances.
- **Condensation**: Condensation buildup on the sensor itself can affect the accuracy of sensors such as ultrasonic.
- **Chemical Compatibility**: Sensors that come into direct contact with the medium need to be made of materials that are compatible with the medium being measured. The "wetted parts" of the sensor need to be checked against manufacturer SDS, and when in doubt, tests should be performed to confirm compatibility.
- **Tank Fills**: When service companies fill the tanks the resulting turbulence inside the tank can cause equipment inside the tank to shift, potentially affecting the sensor. A good example of this is when a hydrostatic pressure transducer moves inside a horizontal cylindrical tank, either from one side to the other or up/down the curved portion of the tank, which may change the height of the liquid column above the sensor. Another issue related to hydrostatic pressure transducers during fills is possible over-pressurization of the transducer due to the velocity of the incoming chemical during fills.
- **Fluid expansion/contraction**: The fluid being measured can expand or contract depending on the ambient temperature. This causes a corresponding rise/fall in the liquid level.
- **Tank expansion/contraction**: Just as the fluid inside the tank can expand or contract, the tank itself can expand or contract based on ambient temperature, also affecting the level of the fluid.

Technologies

A wide variety of sensor technologies exist for liquid level measurement, each with associated strengths and weaknesses. Following is a quick look at the most frequently encountered technologies.

Switches

Liquid level switches are simple devices that indicate when the liquid has reached a certain point – either low or high. Since they cannot provide a continuous analog reading of the level, these switches are of limited use for chemical injection – they would only be useful to indicate a low/empty tank. As mentioned above, knowing the actual liquid level is critical to enabling dosage rate calculations, and as such, switches are rarely used in this domain.

Hydrostatic Pressure

Hydrostatic pressure transducers measure the amount of pressure exerted by a column of fluid. The amount of pressure measured is proportional to the height of the fluid column, regardless of tank shape. This pressure is translated into a liquid level by the transducer. Hydrostatic pressure transducers are typically calibrated assuming the liquid being measured is water. Therefore, you need to know the specific gravity of the liquid whose level is being measured to obtain accurate results result. Additionally, hydrostatic pressure transducers use barometric pressure as a reference, and as such, the tank needs to be properly vented. Alternatively, two pressure sensors can be used – one in the head space between the chemical surface and the top of the tank, and one at the bottom of the tank – to calculate a differential pressure.

Ultrasonic

Ultrasonic sensors use high-frequency sonic waves that are reflected off the surface of the liquid being measured. The time it takes for the reflected wave to arrive at the sensor is proportional to the distance traveled. These sensors do no make contact with the medium. They are dependent on the speed of sound in air, so chemical vapors in the head space of the tank can affect the accuracy of readings. Changes in temperature of the vapors/air in the head space can also alter readings.

Guided Wave Radar

Guided Wave Radar sensors beam microwaves down the length of a probe immersed in the medium being measured and measure the time it takes for the reflection to arrive at the sensor. In principle it is similar to ultrasonic, but since it is not a sonic wave it is not subject to changes in head space composition or temperature.

Magnetostrictive Float

Legacy float level sensors use a buoyant object less dense than the medium it is measuring and denser than the head space of the tank. In Magnetostrictive Float sensors the float contains a series of magnets, and as the float travels up and down the sensing rod/cable it registers a change in the liquid level.

Capacitance

Sensors in this category rely on the fact that the fluid being measured has a dielectric constant that is much different than the surrounding air in the head space. A transmitter is connected to a rod which is immersed in the medium being measured. The transmitter measures the change in capacitance which varies in proportion to the liquid level.

Technology Comparison

Following is a comparison of the above-mentioned level sensing technologies.

Technology	Pros	Cons
Switches	• N/A	• N/A
Hydrostatic Pressure – In-Tank	• Cost • Not affected by foaming	• Long cable • Wetted parts/chemical compatibility • Does not perform well in sediment • Does not perform will in poorly vented tanks • Sensitive to ambient temperature swings unless temperature-compensated • Vent tube can become plugged • Requires knowing specific gravity

		• Tank fills can move location of transducer
Hydrostatic Pressure – Out-of-Tank	• Cost • Not affected by foaming • Sediment much less of an issue versus in-tank • Fewer wetted parts versus in-tank • Requires much shorter/no cable versus in-tank	• Does not perform will in poorly vented tanks • Sensitive to ambient temperature swings unless temperature-compensated • Vent tube can become plugged • Requires knowing specific gravity • Subject to errors due to pump stroke action
Ultrasonic	• Non-contact • Good with sediments • Immune to pump stroke action	• Does not deal well with foaming • Does not perform well in poorly vented tanks due to vapors in head space • Must be installed perpendicular to liquid surface – tilted tanks can result in inaccurate readings • Must be installed away from side of tank to avoid reflections • Sensitive to condensation build-up on lens • Sensitive to temperature changes in head space
Guided Wave Radar	• Good with sediments • Tank does not need to be vented • Immune to pump stroke action • Not affected by foaming	• Long probe required – shipping can be awkward • Chemical compatibility issues with wetted materials for probe/cable • Cost
Magnetostrictive Float	• Good with sediments • Tank does not need to be vented • Immune to pump stroke action • Not affected by foaming	• Long probe required – shipping can be awkward (some vendors use flexible cable)

		• Chemical compatibility issues with wetted materials for probe/cable • Cost
Capacitance	• Solid-state • Tank does not need to be vented • Immune to pump stroke action	• Long probe required – shipping can be awkward • Chemical compatibility issues with wetted materials for probe • Must be calibrated for specific liquid being measured

Determining Actual Dosage Rate

Clearly, the only way to know that the right amount of a given chemical is being injected downhole is to ascertain the actual dosage rate that the pump is operating at. The challenge with this is that, in general, the pumps used for chemical injection do not have an *absolute* setting that allows a user to dial in a specific dosage rate in, say, gallons per day. This is because the pumps themselves do not know how much liquid they are pumping due to several factors:

- Changes in downhole pressure affect how the pump performs
- Changes in liquid viscosity as the temperature changes can result in varying dosage rates
- The pumps typically do not have any integrated metering technology to measure actual flow
- If powered by solar panels, the varying voltage can affect pump speed, and thus dosage rate

Instead, most pumps have settings that let the user change the *relative* dosing and leave it to the user to determine the absolute dosage rate externally. Traditionally, this has been done by using a sight glass/calibration column connected to the outlet piping of the tank. The sight glass has a graduated tube, with each marking representing a certain dosage per 24 hours. The glass tube gets filled with chemical by a tech and a valve is closed to seal off the tank, resulting in the glass tube being the only source of chemical for the pump. The pump is then operated for a given amount of time (usually one minute) to determine the number of intervals the liquid drops, and multiplying this number by the scaling factor of the sight gauge yields the approximate dosage rate.

This approach suffers from several problems:

- It requires someone to be on site to perform the test.
- Depending on the specific sight gauge being used, there is the potential for significant inaccuracies in the scaling/conversion from intervals to dosage.
- There can be great variability between one timed dosage test and the next, even if done consecutively by the same tech.
- The results obtained by one tech can vary greatly from the results obtained by another tech, even if the tests are done within a couple of minutes of each other.

- If the dosage rate is extremely low then this may amplify the error (depending on the type of pump being used) because when a pump controller stops a pump it may be at the start of a stroke, at the end of a stroke, or somewhere in between. So if a pump is only stroking a couple of times in a one-minute period this variability has a higher impact on the overall rate.
- The calculated dosage rate is only accurate for the exact point in time the test was performed. Several factors could result in varying dosage rates over days and weeks, such as changes in downhole pressure, varying temperature, pumps slowing down at night (more on this later), etc.

Clearly, automation offers a better way to do this.

Automation Options

The obvious choice for determining actual dosage rate is to use a flow meter. However, it is a challenge to measure flow rates when the rates are extremely low and flow is intermittent. To date, the types of positive displacement flow meters needed to get an accurate flow rate have been prohibitively expensive for the chemical injection market.

Some pumps are “metering” pumps, meaning they estimate the flow rate using integrated components. As with flow meters, these pumps tend to be much more expensive than the typical vanilla pump seen in the oilfield, and as such, are not popular in the chemical injection market.

A more economical way to determine actual dosage rate is to measure the changes in liquid volume over time. Using a liquid level sensing technology, the level is converted to volume (more on this below), and the volume is logged over a specified period of time to determine the effective dosage rate. Since presumably there is already a liquid level sensor on the tank as part of automating the chemical program, there is no additional equipment or labor required to implement this technique.

It should be noted that the concept of instantaneous dosage rate is not useful nor practical for chemical injection. This is because the focus is typically on how much chemical is delivered per *day*, not per *second* or per *minute*. To allow the level to change by a measurable amount, and to eliminate the impacts of temperature changes between day and night, the actual dosage rate should usually be computed using a trailing 24 (or more) hours of data.

Challenges

Factors that can affect the technique of using changes in volume over time include:

- **Temperature variations**: The same effects that temperature has on liquid level sensing also manifest themselves in the calculation of actual dosage rates. So, for example, variations in temperature between day and night can show up as corresponding increases/decreases in dosage rate.
- **Changes in viscosity**: As the viscosity of a chemical changes with temperature fluctuations, the pump’s ability to move the same amount of chemical per unit time changes, thus affecting the pump’s effective dosage rate.
- **Battery-powered pump slow-downs**: For pumps that are powered by a solar kit, the battery is frequently under-sized or has been damaged due to frequent charging/discharging cycles (most batteries included in solar kits are lead acid, which are not optimal for solar applications). This results in the battery not being able to deliver the necessary power to the pump for an entire night. The consequence is that either the pump does not run for a portion of the night or runs at

a slower speed due to the reduced voltage, with a corresponding reduction in dosage rate during night hours or cloudy days.

It should be noted that using trailing 24-hour (or longer) historical data for dosage rate calculations mitigates the above challenges.

Determining Volume from Level

As discussed above, tracking changes in volume over time offers the most economical way to estimate actual dosage rates. What is needed now is a way to measure the volume of chemical in the tank at any given point in time.

Techniques

Setting aside more exotic/obscure methods such as acoustics, the only somewhat practical way to measure volume directly is to use a load cell to weigh the tank and its contents, subtract the weight of the tank, then use the density of the liquid to calculate the volume. However, load cells would be tricky to deploy onto chemical tanks, possibly requiring the use of multiple cells to get adequate results, adding too much cost to be truly practical. And it is impractical to weigh the tank, supporting structure, and connected plumbing accurately when in the field.

Given that there is a sensor already in place to measure the liquid level, all that is needed is a method for converting the liquid level to volume. This process would be trivial if all tanks were a vertically oriented radially symmetrical shape such as a cylinder. However, the most popular tank geometry encountered at onshore wells is a polyethylene horizontal cylindrical tank with supporting legs that result in a non-uniform shape. As such, the conversion from level to volume involves more than a simple geometric equation. Instead, the volume must be estimated by using a technique known as *strap tables*.

A strap table (aka strap chart/calibration table) consists of multiple entries, with each entry indicating a corresponding volume for a given level, resulting in a non-linear curve when the points are plotted on a graph. To calculate the volume for an arbitrary level the two entries closest to the given level are found and then the volume is interpolated between these two points on the curve. This technique allows for the calculation of volume for arbitrary tank shapes. The higher the number of entries the better the resulting accuracy in the conversion. Tank manufacturers sometimes provide a strap table with their tanks, greatly simplifying this process. However, in the absence of a strap table from the manufacturer, the table must be created by hand. Most of the tanks in question have exterior markings to indicate volume at certain intervals. Using these markings, one can simply measure the height of each marking to build the strap table. However, these markings are for the most part inaccurate approximations of the true volume and tend to not yield good results for dosage rate calculations, and are also too spread out to generate enough data points. A better approach is to “strap the tank”, meaning adding known volumes of a liquid (usually water) at a time and measuring the liquid height, slowly building out the table. Admittedly, this is a time-consuming process, but worthwhile if accurate dosage rates are deemed critical and the dosage rates are low (say, less than 1 gallon per day).

Challenges

Strap tables are vulnerable to the following factors:

- **Not enough data points**: The lower the number of entries in the strap table the higher the error in the conversion due to the linear interpolation.
- **Variations in tanks**: Strap tables are typically reused for tanks of the same make and model. The tank manufacturing process results in slight variations that can affect the conversion from level to volume. This can also be exacerbated by deformations in the tanks once they have been deployed due to exposure to weather.
- **Incorrect liquid level calibration**: If one were to plot the strap table of a typical horizontal cylindrical tank it would yield a characteristic "S" curve, where changes in volume in the mid-section of the tank are more dramatic as the level changes, and less so toward the lower and upper ends. If the level is not properly calibrated this can result in plotting points on the wrong part of the curve, resulting in dosage rate calculation errors. This is especially true when the markings on the exterior of the tank are relied upon for generating the strap table.

Controlling Pumps

Up to this point we have discussed obtaining tank levels and calculating actual dosage rates. The final piece of the puzzle is the control of the pump to achieve and maintain a target dosage rate. This seemingly simple-sounding process is complicated by the large variety of chemical pumps in use:

- Mechanically Actuated Diaphragm
- Positive Displacement
- Gear
- Pneumatic
- Etc.

And each of these types of pumps have varying degrees of external/remote control, from nothing to full Modbus support for changing the pump speed and/or stroke length. Since it is not realistic to ask operators to replace their pumps with versions that allow full remote control, the implementation of pump control must deal with all these variations.

The external/remote control capabilities of pumps can be decomposed into the following categories:

- Modbus: a serial connection that allows pump settings to be changed via software interface
- Analog Input: a voltage/current signal that allows a pump's speed to be changed via a corresponding analog output on the remote device
- No external control: these pumps have an integrated controller but only have manual knobs for a person to change the settings locally

In general, since the method for controlling these pumps involves making relative changes to the current settings, it is convenient to use percentage to describe the range of control, wherein 0% represents completely off and 100% represents the maximum capacity of the pump when it is turned on constantly. For the case where there is no external control on the pump, the percentage represents a Duty Cycle that determines how long a pump is turn on/off for a given period. For example, a Duty Cycle of 20% and a period of 60 seconds would result in the pump being turned on for 12 seconds and then turned off for the remaining 48 seconds. The actual mechanism for turning the pump on and off involves the use of a relay/contactor to switch the pump's supply voltage (or in the case of a pneumatic pump, to open and close a solenoid valve to control gas flow).

Many pumps have a controller that can be bypassed to allow an automation system to control the pump directly. However, some pumps have an integrated controller that itself turns the pump on and off to control the dosage rate. For the latter case, in order to make available the entire pump capacity range to the automation system, the pump settings are all changed to their maximum levels.

Challenges

The effectiveness of controlling dosage rate by turning the chemical pump on and off is affected by several factors:

- **Oversized pumps**: Some chemicals require very low dosage rates (on the order of one or two pints per day). However, to overcome high downhole pressures large pumps frequently need to be used. This requires using very low Pump Duty Cycles (2-3%) that result in as low as one pump stroke per minute. This makes it more difficult for an automation system to deliver a consistent amount of chemical during each cycle for certain types of pumps since a) the pump may continue to pump some chemical after power is cut off due to momentum of the motor, and/or b) for any given cycle the pump could be stopped at the beginning of a stroke, the end of the stroke, or somewhere in between, and this variation becomes a bigger factor when the dosage rate is low.
- **Integrated pump controllers**: When the automation system switches power to these kinds of pumps there is some variability in the boot-up time of the controller, which needs to be taken into account. Additionally, local changes to the pump's settings can cause confusion since there are now two points of control.

External Control Inputs

There are certain conditions under which the normal dosage regimen should be suspended. For example, certain chemicals such as methanol only need to be injected when the temperature falls below a given threshold. Another example is when a well is shut in – the state of the slipstream pressure can serve as an indication that the pump should be stopped. For maximum flexibility and efficiency, the automation system should be able to handle arbitrary conditions in the form of "interlock" permissive inputs that can disable the pump indefinitely.

Dosage Rate Control Strategies

As explained above, the Pump Duty Cycle is the key to controlling the dosage rate of a chemical pump. There are several options for determining the value of Pump Duty Cycle based on the needs of the operator.

Manual Adjustment to Pump Duty Cycle

The most basic option is for users to make manual adjustments to the Pump Duty Cycle by comparing the historical Actual Dosage Rate against the Target Dosage Rate. This option is for users that do not want a full closed-loop system and would rather make adjustments themselves in the automation system.

The most basic way to perform manual adjustments is to ignore changes in pressure or other external factors and assume that a change in Pump Duty Cycle is exactly proportional to the change in dosage rate as follows:

[New Pump Duty Cycle] = [Current Pump Duty Cycle] * ([Target Dosage Rate] / [Actual Dosage Rate])

Automatic Pump Duty Cycle Adjustments Based on Target Dosage Rate

To implement an automatic closed loop system a PID control loop can be used, where:

PV = Actual Dosage Rate
SP = Target Dosage Rate
CO = Pump Duty Cycle

At the end of each update loop a new Pump Duty Cycle is determined by the PID algorithm to minimize the error between the Actual and Target Dosage Rates. This method can account for other external factors such as downhole pressure changes as well as variations due to temperature effects, as discussed earlier.

Automatic Pump Duty Cycle Adjustments Based on Target Dosage

This option is a simple extension of the above option, but with the added ability to take Target Dosages (PPM) and apply them to actual production volumes to determine a single Target Dosage Rate. This simply automates changes to the Setpoint of the PID controller described above. This option can be used when Production Volumes and Target Dosages are readily available to the automation system.

Exception-Based Chemical Injection Program Management

The above-described automation strategy results in high visibility into the tank levels and pump dosage rates managed by an operator, along with options for controlling the pumps to change dosage rates. This yields a lot of critical information that can be used as the basis for reports and analytics. It also generates a lot of information that people need to sift through, which is a typical consequence of implementing automation systems.

The problem is that humans have a limited ability to sort through large quantities of information on their own. An effective chemical injection program needs to put critical information at the top of users' queues so that they can prioritize their actions. This is known as "operating by exception".

Critical Exception Events that should be generated by the automation system include:

- **Low tank level**: alerts appropriate personnel to schedule a tank fill
- **Potential leak**: a sudden drop in level indicates a potential leak – either due to a split tank, damaged pump, leak in the tubing line, etc.
- **Under- and over-dosing**: alerts personnel about improper dosage rates that require an adjustment to the pump. If the system is performing automatic pump control then these events should be rare and likely indicate a problem with the pump.

- **Pump issues**: pumps can fail in many ways – mechanical failure, vapor locking, etc. An absence of change in the tank level is an indication that the pump is not doing its job.

Detechtion's Chemical Management System

Detechtion offers a suite of products for chemical injection automation that include tank level monitoring, dosage rate calculations, and pump control, all managed and tracked via the Enbase™ Dashboard cloud service. There is also a mobile app that allows operators to track chemical-related activity at their wellsites.

TLS

The Enbase™ TLS is a wireless, battery-powered tank level sensor that monitors the chemical level in any kind of vented tank. Since it is satellite-based, it can be deployed world-wide (except for near the poles).

TLS uses a hydrostatic pressure transducer connected to the "head" unit that is mounted on top of the tank using a bulkhead adapter, with the transducer itself sitting on the bottom of the tank. Alternatively, the transducer can be installed on the outlet piping of the tank, with the head unit mounted on the tank or solar kit pole/panels. TLS has a sophisticated filtering mechanism that removes noise from the level signal resulting from the pump stroking action.

TLS can be configured to transmit level data as frequently as six times a day, and each sample includes the temperature and battery voltage. It also includes geo-fencing and asset tracking via an integrated GPS module. It is an extremely affordable option when all that is required is the tracking of chemical levels and calculation of dosage rates.

CAS

If pump control is a critical component of an operator's chemical automation program, or if multiple tanks exist at a given site, Detechtion also offers the Enbase™ Chemical Automation System (CAS). CAS can monitor and control up to four tanks/pumps via integrated relays/contactors. Users can choose to control the pump dosage rates remotely themselves or choose one of the closed-loop options for full automation.

Users can connect to CAS via Wi-Fi to monitor/control the tanks/pumps locally. This is useful for calibration of the level sensors as well as to perform troubleshooting.

Enbase™ Dashboard

Detechtion's Enbase™ Dashboard is a cloud-based system for data archiving, visualization, configuration and reporting. Field devices such as TLS and CAS send data to the Enbase Dashboard at their configured frequencies. Enbase™ Dashboard also supports third party devices.

Fieldlink™

Fieldlink™ is a mobile application that tracks activities performed by service companies on chemical injection tanks and pumps. It tracks chemical deliveries (truck and continuous), pump adjustments, samples, etc. It is a cloud-based system that works offline in areas where there is no network connectivity. Once the device has network access it syncs data to the server.

Fieldlink™ allows for the sharing of data between operators and chemical service companies to ensure everyone is on the same page. Additionally, Fieldlink™ has been successfully integrated with the most popular ERP/MRP systems (SAP, Oracle, etc.).

About Detechtion Technologies

Detechtion Technologies™ is the market leading Industrial IoT and mobile application provider enabling the digital oilfield. Through its Analysis™, Enbase™ and Fieldlink™ product lines, Detechtion offers solutions for chemical injection, compression, and other production operations. Using Detechtion's *Monitor, Protect, Control, Optimize™* paradigm customers are able to automate assets with a single hardware device. Over 100 customers and thousands of users depend on Detechtion Technologies™ to monitor and manage over 10,000 assets worldwide.