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Executive Summary
Since the late 1960’s, the Chlor-Scale® type chlorine ton container weigh scale has been in use around the world giving plant operators the ability to accurately document the amount of chlorine used in the disinfection process for water and wastewater treatment. Almost all domestic treatment plants today are also taking advantage of the accuracy and simplicity of using weight to monitor the status of their chemical by pushing beyond the chlorine gas application and into liquid and even dry chemical feed applications. Scales are commonly being used now to monitor chemicals fed from the smallest liquid drums (“carboys”) all the way up to large bulk storage tanks and all the vessel sizes in between.

This white paper discusses the different traditional ways of monitoring liquid chemicals, chemical feed scales designed for different types of liquid tanks, and differences in weighing technologies to consider when selecting a weight based system.

Liquid Chemical Feed Monitoring
In recent years, the use of liquid chemicals in water treatment has increased substantially and with this has come the need to safely and accurately monitor the amount of chemical used and the amount that remains. Federal and state agencies often require or recommend that liquid chemicals such as fluoride and sodium hypochlorite be monitored by weight to insure proper dosing levels. For other liquid chemicals such as caustic and polymer, plants choose to monitor by weight for feed optimization.

Prior to using weigh scales for monitoring liquid chemicals, level probes, float switches and ultrasonic sensors were the “advanced” methods. If none of these were employed, then recording levels was simply limited to tank graduation marks and sight tubes. All of these gave some indication of chemical status but they had obvious accuracy limitations. There was also fouling and maintenance issues since these devices had to be located inside the tank where they would come in contact with the harsh chemicals and vapors. Servicing the devices then presented a safety issue since the operator would inevitably come in direct or close contact with the chemical, risking splash injury and fume inhalation. Since these devices were required to be mounted in or on the tank, using them for portable tanks where the empty tank would be regularly replaced by a new full tank was also not an option.
WEIGH SCALES FOR MONITORING CHEMICAL FEED in WATER & WASTEWATER TREATMENT

Instead of placing a sensor inside the tank, more treatment plants are now setting their liquid chemical tanks on top of a weigh platform. Using a scale provides the best accuracy of any measurement device, the technology is reliable, and when using a scale specifically made for chemical feed applications, will provide years of service life in the harsh chemical environment.

Chemical Delivery - Portable and Bulk Tanks

Liquid chemicals are typically transported to the treatment plant in portable vessels or by tanker. For small to medium supply requirements, chemical is delivered in small 15 to 30 gallon carboys (drums), 55 gallon drums, or the now popular 275-325 gallon IBC (Intermediate Bulk Container) Totes. These are off-loaded from the truck at the treatment plant and the empties are then loaded on the truck to head back to the chemical plant for refilling. When the chemical is delivered in carboys, drums and totes, process piping is usually hooked directly to these containers and chemical is fed out of the them into the treatment process using a metering pump. Platform scales are the most common method for monitoring the amount of chemical fed from carboys, drums and totes. The new, full vessel can simply be placed on the platform and monitoring begins. No installing of devices or contact with the chemical is necessary. Platform scales such as the Chem-Scale™ are designed specifically for liquid feed applications and provide the necessary durability and accuracy that these applications require.

For medium to large supply requirements, a tanker truck off-loads chemical at the treatment plant to an onsite storage tank. Sometimes the plant will feed directly from these bulk tanks but often the chemical is transferred from the bulk tanks to smaller day tanks from which it is then fed into the treatment process. To monitor the chemical in a large bulk tank, tank weighing modules such as the Procell® are placed between the tank supports (legs or saddles) and the floor. If the bulk tank is a poly or fiberglass flat bottom style, then typically an ultrasonic sensor is placed in that tank and then a weigh scale is placed under a smaller day tank to give the best accuracy.

Platform Materials

Weigh scales are now available for liquid treatment chemicals that address the specific demands of the application. Durability is a key factor for the harsh chemical environment and manufacturers address this in different ways. Platform materials range from solid PVC plastic to thick polyurea coated steel,
and even 316 stainless steel. All of these can provide many years of service life in a chemical feed room. Solid PVC platform designs are typically limited to 55 gallon drums and smaller. Polyurea coatings such as Tuf-Coat® offer excellent corrosion protection to steel platforms and allow platform scales to be offered over a large size and capacity range at reasonable prices. Stainless steel can be the most durable for some applications but the high cost of 316 stainless steel often cannot be justified, and 304 stainless steel is usually inferior to mild steel with a good coating system.

Scale Technologies

Most scales are comprised of at least three parts; an indicator of some sort to display the weight, a platform or support structure for the tank or vessel, and at least one load cell (sensor) located under the scale platform that transmits the weight sensed to the display.

Weighing technologies are divided into two broad categories; those that require power for operation and those that do not. Electronic scales use electronic load cells and electronic displays. These scales typically provide the highest accuracies and the easiest readability for the operator. Hydraulic and mechanical scales display the weight on a dial or mechanical meter. They do not require line power so they are immune to the most frequent cause of failures in electronic scales—lightning and power surges or spikes. There are also scales that bring the best of both technologies together by using hydraulic load cells and electronic digital indication.

Another difference in scale systems is whether or not the platform is completely supported by load cells or is pivoted using hinge feet and a single load cell. Most industrial type platform scales use a load cell in each of the four corners of the platform. In a liquid chemical feed application though, the material in the tank has a fixed center of gravity and a pivoted style platform can be used reducing the purchase price and the number of components that can fail. The difference in accuracies between pivoted and non-pivoted systems is 1/4 of 1% full scale accuracy versus 1/10 of 1% full scale accuracy which for many chem feed process applications is insignificant.

The scale instrumentation available for chemical feed applications also differs from standard weigh scales. Normally a weigh scale provides a weight display and a method for zeroing the instrument so only NET weight is being displayed. Chemical feed scale instrumentation offers
unique features to help operators track critical information and control some operations. Advanced weight indicators such as the Wizard 4000® display net chemical weight, feed rate, daily chemical used, days until the tank will run empty, and can show current amount in tank visually with a bar graph. The system also tracks the daily amount used for each of the previous 31 days in a user accessible log. Usage values can even be kept accurate while tanks are refilling and feeding simultaneously by using a pause and project function. Other features allow remote monitoring through 4-20mA outputs and RS485 and also level and rate alarms via relays.

Some liquid feed applications require simply a net weight function that can be transmitted back to a SCADA system. These types of basic displays are also available. Other functions that indicators provide are integrated day tank refill control and chemical specific data such as the HypoTrak® indicator does for sodium hypochlorite feed applications. Chemical degradation monitoring, vapor locked metering pump alarms and chlorate formation monitoring addresses issues that are unique to that chemical.

Conclusion
Weighing systems for liquid chemical feed applications can help treatment plants comply with regulations and recommendations to accurately track chemical usage, can help make the chemical feed process run more efficiently and can improve operator safety. No matter what level of data is required or the types of tanks involved, there are weighing systems today that can provide exactly what is needed.