Technical Assistance Bulletin

Safety First… Be Smart

By: Don Craig, IRWA Deputy Director

June 2023 Newsletter

In what seems like a different lifetime… Many, many years ago my life's "time" came very close to ending while working on a broken sewer line. Even today, I shudder when I think how close I was to that end.

Safety on the job, no matter what job it may be, should be the foremost concern before resolving the task at hand, or even an emergency, if at all possible.

This story takes place late in the afternoon on a Friday…of course… with a contractor trying to uncover a large sanitary sewer main line on the outskirts of my home town. They were trying to expose the wastewater main, so they could ready it for a new connection to the bank building that was under construction nearby.

To set the 'stage' as to what they were dealing with in trying to uncover the line, was one of a ground situation that included about five feet or so of dirt, and lots of sand and gravel below that. Oh yeah, and one more added ingredient… water! Gallons of endless groundwater percolating up, over and through the sand and gravel, and continually filling the hole as they were digging with the backhoe.

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Needless to say, it was very hard, if impossible, for the contractor to see what he was trying to find and uncover. About five feet down, the water main line that was near the west wall of the excavation, literally had uncovered itself somewhat, as the water-logged sub-soil washed away with the further depth of the digging as they tried to get to the sanitary sewer line, which ended up being approximately nine to ten feet deep.

Unfortunately, the operator of the backhoe ended up hitting the large sewer line, and breaking the top half of it completely in about a two foot section. It was at this point that they called the city crew about the incident.

When we got there, the contractor tried to create as much as a sump hole as possible to the side of the affected wastewater line, and we immediately started up the pumps, in trying to get a handle on the excess water.

This is the point where calmer heads should have prevailed. That did not happen. We should have had a trench box inserted into the hole, so that repairs could have been started and completed, safely. The apparent 'need' of getting it fixed as quickly as possible, wrongly took priority.

Now, you have to remember this was well over 40 years ago. No, that's not an excuse, it's just the way it was. And, of course, it was not the right way.

Anyway, myself and another city crew member had gotten down into the hole and worked our butts off trying to fully uncover the sewer line that had been damaged, so we could start repairs. But, as you can imagine, the uncontrollable amount of ground water coming through the walls made that totally impossible as the sand and gravel continually covered up everything we were trying to accomplish.

And, to make it worse, the water logged situation started to cause wall cave-ins. We continually had to get out of the way for ground giving way, and go on and on with continual excavation of the hole and sump. The trench was quickly becoming a large four-sided hole. I made my plea many, many times to the "higher ups" who were topside, including the mayor at that time…who had decided he needed to be there….that we were fighting a losing battle without shoring.

Anyway, after going up out of the hole for better digging, I strongly told the supervisor at that time that once we got back down there, that all of them looking down, make sure to keep close watch and warn us if the walls appeared they were going to fall in more.

I had just got down the ladder, after the other guy had made it down, and was beginning to bend over to help uncover the damaged line, when all I heard was screams! I looked up just in time to see the entire south wall falling towards me. I don't know how, I guess it was just a reaction…a lucky one…but I went backwards to the north side up against what was basically the firmest wall as it was near the foundation of the building being constructed.

When the dust cleared……no, when the mud, gravel, sand, and water cleared…. I was pinned up against the north wall with all that debris clear up to my arm pits. Luckily, I had kept my arms raised and they were exposed. The other crew member was buried to some degree as well against another wall. He was able to get out up the ladder, but I had to be literally pulled out by hanging onto the backhoe bucket.

Oh the things we do….

Needless to say, I was very vocal when I got topside. After taking my mud, gravel, and water filled hip boots off, which I threw right onto the feet of the supervisor and mayor… I had my 'input' on the situation with some very choice words, to say the least. The line I remember that only had one curse word in it was, "Is it going to take someone getting "freaking" killed, before we're smart enough to get shoring in that hole!"

That was the line that finally initiated the call to a local contractor just down the road with a shoring box on hand. (I really think the muddy boots had a lot to do with it, as well…ha!)

Within a half hour or so, we had a box inserted. Within another hour or so, we had the problem fixed. This was after nearly two hours of wasting our time before, and worse, almost killing two human beings.

Being smart and safe, go hand in hand…. Don't make your own personal bad judgement and experience, be your teacher before doing so.

Monitoring Well Performance

By: Marc Lemrise, IRWA Circuit Rider

Ensuring that your source of water is adequate to meet the needs of the customers is an important part of maintaining a public water supply. Identifying a problem early on can prevent an emergency situation from occurring in the future. Checking the performance of your wells and recording the results on a monthly basis can do just that.

Current draw is one indicator of the condition of your well pump and or motor. Typically, these are three phase motors, requiring each leg to be checked independently while the motor is running. If you have never done this, and don't have ammeters built into your electrical panel, have a qualified electrician show you how to do it safely. Once you have established a baseline you can compare the amount of current that the motor is drawing with previous data to identify a trend. For example, if terminal #3 has drawn 21 amps for the last five years and now it's pulling 27 amps there could be a serious problem with the motor and or the pump.

Specific capacity is the primary indicator of well performance, pump issues notwithstanding. Specific capacity illustrates a well's ability to produce water in proportion to the drawdown. Expressed in gallons per minute per foot of drawdown, once a baseline is established through months or years of data, a significant decrease in specific capacity is a red flag, alarm bell, warning or whatever you'd prefer to call it. When this happens, it's time to get professional help from a qualified well service company.

Usually, the best place to start is with a video inspection of the well. This enables the operator to see if the structural integrity of the casing is intact, screens are plugged or excessive debris has accumulated at the bottom. Treatments may include brushing, surging, air blasting or in rare instances, explosives. The most common treatment though is acid which dissolves mineral deposits on the screen and in the gravel pack. Combining acid treatment with one or more of the other technologies has been proven to be effective in restoring lost specific capacity.

Where does one start? If you do not have previous records for your wells' drawdowns, it's impossible to determine whether or not the data you are recording today is within the "normal" range for that well. If that is the case in your system, let's get it started in here.

Many SCADA systems have pressure or ultrasonic transducers already in place that make it exceptionally easy to measure your drawdown. If you have 45 feet of water column above your pump while not running (static reading) and 36 feet after it runs for half an hour, (dynamic reading) the drawdown is 9 feet. If that 9-foot drawdown occurs while pumping 600 gallons per minute one would divide 600 (GPM) by nine (ft. drawdown) for a specific capacity of 66.6 gallons per minute per foot of drawdown.

If you have only an air line and pressure gauge, there's a little more to it; but only a bit. Pumping air into the tire chuck with a bicycle pump or compressor until the gauge stabilizes will provide a pressure reading which you can then convert into feet of water column by using the conversion factor of 1 PSI = 2.31 feet of elevation. For convenience's sake, if your pressure reading was 23.1 PSI, a 10-foot column of water exists above the well pump. (23.1 divided by 2.31) Performing this operation once after the well has been at rest (static) and then again after it has been running a while (and still running) will provide you with all the necessary information to accurately calculate your drawdown. This older technology is time tested and proven; accurate and inexpensive.

The only piece of the puzzle now missing in specific capacity calculation would be the gallons per minute. There are multiple types of flow meters in existence and in operation today and they're all pretty accurate if they're calibrated periodically. Most modern meters will not only measure flow totals but also flow rate in GPM. If you are operating with an older master meter the GPM can be calculated by using a stopwatch to time one full revolution of the "second hand," usually 100 gallons. If 100 gallons takes 23 seconds, for example, one would convert the seconds to minutes by dividing by sixty. This tells us that 23 seconds is 0.383 minutes. 100 (gallons) divided by 0.383 (minutes) = 261 gallons per minute.

A simple excel spreadsheet printed with large enough line spacing to write on is the simplest way to track your well performance. Keeping the form in your well house on a clipboard hanging on the wall will serve as a reminder to check your well performance at least once a month. I had done this for over ten years and month after month nothing ever changed…. Until it did. A 6-inch well with a specific capacity of 15.8 GPM/ft. of drawdown slowly dropped to 4.6 GPM/ft. of drawdown over a period of six weeks. After brushing, bailing and acid treatment, the specific capacity of this well increased to 31.6 gallons per minute per foot of drawdown.

Fortunately, this issue was identified before the dynamic water level had dropped to a point where the pump would sustain any damage or start sucking air. If you would like to start tracking these data points in regard to well performance, contact your circuit rider to help you set up a program. It's never too late to start.

An Evolving Industry

By: Steve Vance, IRWA Training & Technical Assistance Specialist

While traveling the State conducting training and providing technical assistance, a conversation often develops regarding imposing and onerous regulations impacting community water supplies. Hearing different perspectives and interpretations of certain laws and regulations is always interesting and prompted me to research the history of water treatment and the implementation of laws and related regulations.

When I think back to when my career in the industry began at a small iron-removal water treatment plant in the late 1970s, my given priority was to make sure that there was always sodium hypochlorite in the day tank, the chlorine injector was not plugged, and be extremely careful when taking coliform samples. Now, at the twilight of my career, it amazes me how the industry has changed. For better or worse, likely depends on perspective. However, there is little doubt that potable water quality in the United States has drastically improved over the course of generations.

Originally, water treatment focused on the aesthetic quality of drinking water with little regard to potential health impacts related to potential contaminants within the water. Efforts have been recorded indicating that carbon filtration was used to reduce color and odor qualities in drinking water around 4000 B.C. It is also recorded that early Egyptian civilizations used alum to coagulate and settle particulate matter from drinking water. This represents some of the earliest efforts to treat water for consumption.

Moving forward, in the 1700's coagulation with filtration was established as an effective way to increase the clarity of water. However, there was still not a way to create a relationship between aesthetic water quality and health risks related to microbial and chemical content of the water and there was no way to provide a numerical value to water clarity, or turbidity, as we know it.

In the mid-1800s science had evolved and a greater understanding of drinking water contaminant impacts were brought to the forefront. A distinction between the aesthetic quality of water and potential health risks associated with water consumption developed. Later, in the late 1800s, it was demonstrated that microbes, not visible, could transmit disease through water. Also, a relationship between turbidity and an increased likelihood of pathogens was developed. This premise is based on the fact that pathogens are often harbored in particulate matter within a water column.

As a result, treatment technology expanded and disinfectants began being used to reduce/eliminate microbial contaminants. Jersey City, New Jersey became the first community water supply in the United States to employ chlorine as a primary disinfectant in 1908. While many advancements have been made in water treatment technology, the use of disinfectants played a significant role in reducing outbreaks of typhoid, dysentery, and chlorera. Since, other disinfectants, with additional benefits, have been developed and used. Specifically, chloramines and ozone are used by many systems with specific treatment needs.

Given the new understanding of potential health impacts related to contaminated water, a regulatory approach developed to address the need for better treatment. The U.S. Public Health Service set bacteriological standards for drinking water in 1914. The Public Health Service revised these standards several times and eventually included the regulation of 28 substances. All 50 States adopted these Public Health Service standards as regulations or guidelines until the passing of the Safe Drinking Water Act in 1974. With the Safe Drinking Water Act, the understanding of additional contaminants became clear. In addition to aesthetic problems, pathogens and a limited number of chemical contaminants, the Safe Drinking Water Act addressed advances in industrial and agricultural areas that introduced additional contaminants in drinking water.

The Safe Drinking Water Act has been amended and expanded several times since its inception to include Primary Drinking Water Standards, Surface Water Treatment Rule, Total Coliform Rules, Lead and Copper regulations, Stage 1 and 2 Disinfectants and Disinfection By-Products Rules and Unregulated Contaminant Monitoring Regulations, to name a few, and brings us where we are today in the industry.

While this represents only cursory research regarding the history of treatment and regulations, it is clear that science and technology has driven the need for advancements in treatment and regulatory approaches to protect public health. Advancements in science and technology have enlightened us about the dangers of lead, PFAS, and many other chemicals that were previously introduced because of their application benefits. Now, while benefits of certain chemicals and compounds are still there, we know about the health risks associated with the exposure of these chemicals and compounds. Additionally, we can now detect levels of contaminants at much lower levels and, through research, have an understanding of concentrations of contaminants that impact human health.

In summary, my response to these conversations regarding imposing and onerous regulations is that science and technology has brought us to this point. The transition and advancements over generations represents many benefits and drastically reduced negative impacts to public health. While outbreaks still occasionally occur, there is no doubt that we are able to produce a consistently safer product in the potable water industry. Maybe our workload has increased due to the regulatory approach of protecting public health in our industry, but, that is our primary goal…providing a safe and adequate supply of potable water…while also benefitting from science and technology through the use of computers, SCADA systems, remote meter reading, etc. Keep up the great work!!!

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July 13 & 14, 2023

Topics include

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