by Jon Steele

Well clean-up helps Gypsum produce better water

Recently I assisted the City of Gypsum with a well clean-up and chlorination project on the city's four wells. Gypsum is a small community just south of Salina. Your town or water system may have a "Water Salesman" for your bulk water that was made by Vernon Manufacturing in Gypsum. Mayor Steve Vernon now runs and operates the family business. I have seen those Water Salesman coin machines all over Kansas; they are a great way to boost revenue if you have a demand for that type of service.

Steve was very interested in chlorinating the city's wells since they had not been treated in the decades after installation. I went to Gypsum after his call. Steve described the problems they were having: discolored water and difficulty in maintaining chlorine residual. We discussed what was needed and at that time made plans to assist the operator with the job. Operator Richard Hammon and I worked together until job completion.

Jon Steele
Tech Assistant

Start with samples

When we began work on this project, we couldn't get a sample directly from the wells. So the first step was to install flush hydrants and valves at each well to isolate them from the distribution system. This also enabled us to pump the wells back into a tank for surging purposes during the cleaning process.

Samples were taken and analyzed for inorganic quality. This is a particularly important step in my opinion. I think it's essential to know exactly the properties of the water that we are dealing with and how these may be changed because of the cleaning process. Another preliminary step is to determine the static and pumping water levels. This information can then be used after the cleaning project to determine the effectiveness of the treatment. These pumping rates become invaluable records on pump/motor operation and well drawdown.

The treatment process is ready to begin once all tests have been completed and any plumbing modifications made. The well cleaning process takes time. I suggest making sure to have another source of water or enough storage to last until work is completed — in some cases three days. The longer the high concentrations of chlorine can be in contact, the better. I like to use sodium hypochlorite — the 10 percent stuff. The chlorine

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KRWA Circuit Rider, Jon Steele, and Richard Hammon work to begin treatment process on well #4 for the City of Gypsum.

purchased over the counter is three to five percent at best, if it hasn't exceeded the shelf life. Liquid chlorine losses strength when exposed to warm temperatures or sunlight. It's also important to have a chlorine test kit.

Steele shows a sample of the discolored water being pumped to waste during the treatment process. Treating well #4 improved specific capacity from 1.9 to 2.6. Specific capacity is a measuring expressed in gallons per minute per foot determined by dividing the yield by the drawdown.

A fire tanker truck works great as a tool during the treating process. Most have a 2,000-gallon tank and have had only water in them and have a pump on board to pump the high concentration of chlorine solution into the well. Any clean tank will work if there's not a fire tanker available. I prefer one with at least a 1,000-gallon capacity. The large volume helps minimize trips to the water source; the large volume is also a real advantage when surge pumping during the treatment process.

Quantity of solution varies

Before beginning to treat a well, first determine how large a treatment is needed. If a routine or maintenance treatment is to be done, then I like to displace the casing with the chlorine solution two to three times. Simply, determine the casing volume and multiply it by three times. What I call a "rehab" project needs much more volume. This depends on the type of well formation and pumping capacity and the severity of the problem to be corrected. But generally it involves 10,000 to 20,000 gallons of chlorinated solution. My goal is to have a solution with 1,000 parts per million (ppm) chlorine. At this concentration, there will be plenty of strength even if your chlorine isn't quite 10 percent or you don't get it mixed perfectly. At 1,000 ppm, there should still be residual when you are ready to pump it to waste. Chlorine is inexpensive; this is not where you should try to save a few pennies. I have treated wells that have only one or two parts or even less of free chlorine at the finish of the project, even after starting with 1,000 ppm at the beginning. If there is no free chlorine residual at the end of the surging and pumping, then it has been spent in the cleaning processes and more needs to be added.

The wells at Gypsum were small shallow wells that did not have too severe of iron-related bacterial fouling. Our treatment called for 2,000 gallons of 1,000

ppm chlorinated solution with a wetting agent. Always use a good quality food grade or equal wetting agent. This will enhance the effectiveness of the solution and do a better job of cleaning and penetrating any slime or biofilm that may be present; it enables the chlorine to penetrate and contact better. We were able to mix the solution in a 2,000-gallon tanker and haul it to the site. This was just right for the job and it saved multiple trips to town for water. The water source has to be from other than the well you are treating. After the solution was added to the well, we surge pumped the water from the tank to the well back and forth for several hours to create a mixing and washing effect. Then the solution was allowed to sit in the well at least overnight; several days is even better.

Next comes the pumping to waste. It can take several days to clean up a well once its been treated especially if a large treatment was used. Don't be alarmed if you see black, brown, red or purple looking water and lots of foam. These are results! I also like to catch samples at this time. Start by cycling the pump in short intervals, e.g., operating one minute and off one minute. Then gradually increase the pumping time from two to five, then 10 minutes. After a couple hours of surging you may want to pump continuous. Do this for a couple hours and then shut the well off and allow it rest an hour or overnight. Then start it up again and take samples for turbidity. A simple jar test works well for this. I also like to taste the water if it looks okay. Always take a chlorine reading at the beginning and at the end of waste pumping. When you believe you have the well cleaned, allow it to rest overnight; recheck it again for chlorine residual. I then always like to pull another sample for inorganic analysis. After a well cleaning job the water will almost always taste better.

City of Gypsum Operator Richard Hammon points to holes in the column pipe that were exposed during the cleaning. The bad pipe was replaced.

The last step is to perform the static and pumping water level test again. We compare that to the tests taken prior to the cleaning. Another test I like to perform is the "shut-off head pressure" test. This can be valuable for future reference.

The cleaning project at Gypsum went well, however, we did encounter some problems. After one of the wells was treated the production went down to less than half of what it was before we started. This is not supposed to happen – but it did. From our previous pumping test we had some good data to work with. We performed the test again. The pumping water level was higher than previously, however, the shut off head was half of what it was before the cleanup began. From that information we decided we had a pump problem – so the pump was pulled. After pulling the pump it was obvious what had happened. The discharge pipe was full of holes. We had actually cleaned the rust and scale off the pipe and there was no metal left. The scale was actually sealing off the holes. When we cleaned it up the holes were exposed creating a pump pressure and discharge problem. The pipe was replaced.

Wells are relatively easy to clean up if you have the equipment and some patience. Give KRWA a call if we can be of help.

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