AQUA
WATER SUPPLY CORPORATION
Safe • Reliable • Sustainable

415 Old Austin Hwy.
Drawer P
Bastrop, TX 78602
512-303-3943
Fax: 512-303-4881
www.aquawsc.com

The 2021 Texas Cold Weather Disaster: From the Perspective of a Water Utility

Unprecedented cold weather arrived in central Texas the evening of February 14, 2021 and continued through the following Thursday before barely peaking above freezing temperatures. It was not just the very low temperatures but also the length of time during which the temperatures persisted.

Very early Monday morning on Presidents' Day, February 15, Aqua Water Supply Corporation's field personnel who were monitoring the water system began to see evidence of the low temperature's effects on system performance, though at that point it was not yet a serious concern. Aqua's system had survived very cold weather before and our field personnel from management down were very experienced in successfully dealing with any problems due to cold temperatures. They had also spent the previous week preparing for the predicted cold weather by checking and repairing insulation on exposed piping, placing electric heaters inside pump and treatment facilities, and coordinating on-call personnel and response plans. Unfortunately, these efforts did not prepare the water system for what was about to come.

The Friday leading up to the storm, we learned that ERCOT may have to exercise rolling electrical blackouts if demand during the cold weather placed too much load on the system. Aqua's electrical provider would be required to comply with ERCOT if the blackouts were necessary. What we did not learn was the timing schedule of the blackouts or how long the power would be on and then how long it would be off. The electricity blackouts began early Monday morning, and the effects were immediate.

Aqua's water system, like many others, is quite simple once you understand the concept. Pumps pull water from an underground aquifer and supplies it to a treatment facility. The treatment facility removes impurities to make the water potable and adds chlorine to prevent bacterial growth as it is distributed throughout the system. Pumps move the potable water to ground storage tanks and then other high volume distribution pumps push the potable water out into the system lines that supply elevated storage tanks. The height of the water in an elevated storage tank provides the capacity and pressure in your home when you turn on the faucet. In essence, once the pumps provide water to the proper height in the elevated storage tanks, the function of the entire water system is simply to provide potable water sufficient to satisfy the usage of water in homes and businesses. A utility accomplishes this task by maintaining the water level in its elevated storage tanks. The rolling blackouts degraded, and in most cases, prevented utilities like Aqua from meeting the demands for water placed on their systems resulting in the draining of elevated storage tanks and pipelines.

When the rolling blackouts began very early Monday morning, it was quickly evident that the duration of electrical power was not sufficient to satisfy water demands placed on the system. Electrical power provided for 10, 15, 30, or even 60 minutes is not sufficient to allow pumps to push enough water into elevated storage to satisfy demand. Electronic control systems and pumps, especially Variable Frequency Drive pumps, require from five to ten minutes to complete system checks and spin-up to the necessary RPMs before they can effectively begin moving water into the system. The initial power duration of electricity during the rolling blackouts was in the range of 10 to 20 minutes. This amount of time is not sufficient to even begin supplying the quantity of water needed to satisfy demand. Further, the starting and stopping of the pumps can be highly damaging to the pumps and the water lines fed by the pumps. In summary, the effect

of the rolling blackouts on water systems was to essentially deny them electricity for two and a half days because of the short duration of power. Consequentially, customer demand quickly depleted all elevated storage and pipelines. This situation was further exacerbated by system and customer leaks due to the low temperatures as well as dripping faucets meant to avoid damage to household pipes. Large supply lines from water sources began to freeze for the first time ever. These lines are not normally insulated because water is always flowing through them. In essence, the results were catastrophic.

During and following this event, we heard complaints that the water systems should have been better prepared for this disaster. The lack of generators by water utilities was a very common complaint heard from customers. "We should have had generators at critical sites." To the unacquainted, that appears to be a logical solution. But how do you define a critical site? In a water utility every site is critical to supply water to someone. It is like a chain; break one link and the chain fails. To provide an idea of the power requirements for water utilities, Aqua was told by its provider that if they provided power to the water utilities throughout this emergency, there would not have been sufficient power for anyone else. In addition, the required generators are large and expensive. Aqua's generators are each a $100,000 investment when all costs are considered. For mobile units, transportation is an issue, in particular on icy roads. Maintenance, load cells, quick connects, and fuel are also important considerations. A 250KW generator requires 200 gallons of diesel a day, larger generators even more. During this crisis, diesel supply became a serious issue for just maintaining Aqua WSC's four generators. In a total system power failure, Aqua would require 20 or more generators just to maintain minimum operations and still many in the system would not have water. Aqua has two mobile generators which we use in emergencies to supply power at a site. Historically, in the past twelve years, we have had to use a generator due to an emergency only five times. This is remarkable when you considered Aqua has weathered five declared national emergencies in the last ten years. With this historical record and consideration of this current disaster, is this enough evidence to justify very large expenditures of capital on generators, especially considering other needed improvements and growth? That is a question many utilities will face in the coming weeks.

Another common complaint is the time it took to restore service. Beside leak repairs, equipment repairs, and restoration of power, refilling a water system is just a matter of physics. The objective is to fill elevated storage tanks to return pressure and capacity for customer use. Before you can fill elevated storage, you must first fill pipelines in the ground. Pipelines in the ground hold far more water than elevated storage tanks. Using Aqua's situation as an example, the scale is larger, but the ratios are the same for smaller utilities. Aqua WSC has approximately 2,000 miles of water line in the ground covering about an 1,100 square mile service area. These lines hold about 27.5 million gallons of water. To fill Aqua's elevated storage requires an additional 15 million gallons which totals to a requirement of 42.5 million gallons of water. During recovery, supplying demand to customers who retained service required about 7 million gallons a day. With all facilities operational and pumping, Aqua was supplying about 22.5 million gallons a day leaving 15.5 million gallons a day to fill the lines and elevated storage and satisfy the requirement of 42.5 million gallons to fill the system. You can see the quantity of water required to fill a water system and the enormous task faced by water utilities to return to normal operations.

Certainly, there are lessons to be learned from this disaster. Were utilities unprepared? Perhaps so, but each system is in good company. There were hundreds if not thousands of systems across the south that were not prepared for this once in a generation event. Nearly all were forced into issuing Boil Water Notices because of loss of pressure in their water systems. Nearly all were faced with the task of refilling an entire system with water for the first time in their system's history. Nearly all were faced with criticism about lack of generators and ineffective communications. Was the lack of preparedness a "failure of imagination" as said of the Apollo 1 disaster or a logical result of following historical precedence and lessons learned from the past 50 plus years?