American Water Works Association

WATER LOSS CONTROL COMMITTEE

Pressure Management: Options and Opportunities

Drinking water utilities pressurize infrastructure to provide high-quality service, prevent backflow, and accommodate elevation gradients across service territories. Pressure is typically supplied using a combination of pumping infrastructure, storage tanks and gravity. However, excess pressure, particularly caused by elevation change, can contribute to infrastructure failure and compromise service. As a result, pressure must often be supplied and then reduced to maintain a range of acceptable pressure across a service territory. To reduce pressure, many utilities install pressure-regulating infrastructure like pressure reducing valves.

Many utilities are considering transitioning from a historical posture of reactive pressure management to a more engaged, proactive stance. However, the specific pressure management tools and implementation plans will vary from utility to utility, depending on the utility's intent and the infrastructure already in place. Nonetheless, all pressure management strategies share a unified goal: supply pressure that fully meets service needs while eliminating excess pressure and pressure transients that cause leakage and infrastructure damage.

Benefits of Pressure Management

Pressure management offers a host of benefits for both a utility and its customers. For example, effective pressure management:

- Improves customer service through appropriate service pressures and reduced service interruptions
- Reduces leakage volumes by decreasing both the frequency of leaks and the flow rate of any given leak
- Extends asset life by reducing stress on infrastructure (particularly in the form of pressure transients)
- Decreases energy expenditures in systems with pumping infrastructure by targeting pressure reductions and therefore the energy costs associated with supplying pressure
- Reduces the potential for contamination through pressure transients in which water pressure can be negative for short periods of time
- Can empower more effective demand management through variable pressure supply connected to demand

Considerations and Costs

Pressure management often requires initial investment before benefits can be realized. Most systems in the United States operate as open grids, meaning that targeted pressure reduction requires the installation of additional infrastructure and/or a coordinated pressure optimization plan involving all infrastructure in a service zone. Typically, utility managers and engineers should consider the following questions in planning a pressure management strategy:

- What pressure infrastructure already exists? Where is the infrastructure located? What are its settings, and when was it last maintained or checked for acceptable performance? Answering these questions usually requires an inventory of tanks, pressure-reducing valves, pumps, surge tanks, and other similar assets.
- What pressures are currently supplied throughout the distribution system? Are pressures too low in some places, too high in some places, or generally appropriate for service needs, including fire protection, if provided? Answering these questions typically requires pressure logging at locations (e.g., hydrants) throughout the system.

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- Do pressure transients occur in the system? What infrastructure causes pressure transients? How can transients be mitigated? Answering these questions typically requires pressure logging at a high sampling frequency (greater than one pressure sample every 250 milliseconds) near infrastructure that could introduce transients.
- Is the system currently configured as open grid, or do smaller pressure zones allow for locally targeted pressure modification? Open grid configurations typically require more significant investment in infrastructure, analysis, and planning for pressure management benefits to be realized, but the benefits are often greater once accrued. Conversely, smaller zones (particularly closed zones) are easier to manage pressure in, but the benefits tend to be smaller and more geographically isolated.
- What are special hydraulic requirements throughout the system? Distribution system usually cover large areas with different hydraulic needs. Special considerations might include large demand customers, water age, and fire flow needs. Identification of areas with specific requirements and the strategy to meet those requirements will help the development of a sustainable pressure management stagey.

Methods and Tools

To support pressure management, utilities may consider:

- Installing variable pressure-regulating infrastructure that modulates pressure based on time of day and/or demand. When demand is highest, the greatest pressures can be supplied. Conversely, when demand is low (for example, overnight when irrigation is not occurring), pressure can be reduced to decrease leakage volumes and infrastructure stress.
- Developing district metered areas and/or smaller pressure zones. Closed pressure zones with pressure regulating infrastructure at zone inputs can allow for more precise control of pressures. Furthermore, leakage can be managed on a zone-by-zone basis so that interventions against leakage are more effective.
- Monitoring pressures in real-time using SCADA or comparable tools so that failures in pressure supply (e.g. lower pressure signaling pipe failure or higher pressures suggesting regulating infrastructure failure). The more data a utility has describing system pressure, the more effectively system pressures can be managed.
- Software that times pumping activity with lower energy prices so that tanks are filled when energy prices are lowest day-to-day.

WANT TO KNOW MORE?

Pressure management is often mistakenly interpreted as wholesale pressure reduction. That's just simply not the case! Pressure management refers specifically to the active management of pressure to meet service needs while also extending asset life and reducing instances of infrastructure failure. **Transitioning from reactive pressure management to proactive pressure management can require both a change in mindset and the installation of additional infrastructure, but once accomplished, the benefits of pressure management can be sustained in perpetuity with little effort.**

To learn more, check out:

The American Water Works Association manual M36: Water Audits and Water Loss Control Programs