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Emergency preparedness after COVID-19: A review of policy statements in the U.S. water sector

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ABSTRACT

Although COVID-19 has impacted water and wastewater utilities in new and profound ways, they must still provide their vital services despite the disruptions. The pandemic brings into focus their need for proactive emergency preparedness. In the United States, professional associations have long advocated in this area and have already developed considerable policy guidance and resources to help water and wastewater utilities prepare for and respond to emergencies. In the midst of the crisis, several U.S. policies are reviewed here. Utilities should reflect on their COVID-19 experience, learn from it, and apply their newfound perspective to strengthen future emergency preparedness.

1. A need for preparedness

The purpose of modern water and wastewater services is to bring clean water to those who need it and to make dirty water go away. This is first and foremost a public health responsibility to support human well-being through hydration, hygiene, and sanitation. A failure of these services, even a temporary one, can cause cascading failures in other sectors. Entire communities are vulnerable if water and wastewater services are compromised. These utilities qualify as “critical infrastructure,” defined as “systems, facilities, and assets so vital that their destruction or incapacitation would have a debilitating impact on national security, the economy, or public health, safety, and welfare” (ASCE, 2013).

Fulfilling such a critical role, water and wastewater utilities must continue to enhance their resilience. Society expects them to operate continuously, not only despite, but especially during, disasters (Boin and McConnell, 2007; De Bruin and Van Eeten, 2007; Gheorghe et al., 2007; Duchek, 2014; Curnin and Heumüller, 2016; Curnin, 2018). Water and wastewater utilities cannot withstand the same disruptions as other sectors without causing—or worsening—a public-health crisis.

Emergency preparedness is a key piece of the utility resilience puzzle. Unless a water or wastewater utility experienced a serious disruption in the past that impelled it to comprehensively address emergency preparedness, or without being mandated to do so, such efforts may not have been a priority. However, with COVID-19, every water and wastewater utility has now faced an emergency—which perhaps their longest, deepest, and most widespread emergency yet.

2. COVID-19 impacts

While the full impacts of COVID-19 on water and wastewater utilities will no doubt be the subject of much future study, some are already apparent, as anecdotally reported to the author by employees of various U.S. utilities. Many of the same impacts have been reported in the news media.

Regardless of what they may have faced in the past, the pandemic has impacted these utilities in ways that are novel and profound: with strict social distancing, a need to operate systems remotely and securely, to better protect on-site workers, and/or to shelter in place; with unpredictable supply chains, a need to make do with the equipment, chemicals, and tools they have; with lost revenue due to customers’ inability to pay, a need to dip into cash reserves; and with quarantined staff, a need to quickly find qualified, temporary replacements. And all of this while drinking water regulators still expect compliance and the public still expects safe and uninterrupted services.

Further, these utilities have had to deal with sudden and unforeseen shifts in the timing, magnitude, location, and composition of water and wastewater flows that stress their operations and infrastructure in unexpected ways. With people staying home and being more conscious of hygiene, for example, water use is likely to be higher, peak at different times, and concentrate in residential areas. With a shortage of toilet paper, people have turned to flushing unsuitable materials (especially wipes), clogging sewer lines and wastewater treatment equipment.

To their credit, utilities appear to recognize their important role in dealing with the disruptions and reassuring their customers. Still,
regardless of their preparation up to this point, COVID-19 renews the importance of emergency preparedness policy, planning, and execution for the water sector and communities. At the same time, “As COVID-19 continues ... we will likely see new infrastructure effects emerge. The pandemic presents opportunities to restructure how we design, govern, and educate for a future that will probably see ever more shocks on our systems” (Allenby et al., 2020).

3. Existing policies

The COVID-19 crisis should certainly motivate the water industry to plan more proactively for emergencies. To that end, it may help to review the evolution of current policy statements of two major professional associations that focus on water and wastewater utilities, the American Water Works Association (AWWA) and the American Society of Civil Engineers (ASCE), both which have long-established policy missions. Though state and local governments may have their own policies on the subject, the U.S. Environmental Protection Agency’s (EPA’s) regulatory policies are the most wide-reaching, enforceable, and recent, and therefore particularly relevant as well. The water industry often looks to its professional associations for guidance to comply with or augment existing regulations, so the private (AWWA/ASCE) and public (EPA) policies complement each other.

While a few of the selected policies have been in place for some time, others originated, or were significantly revised, after major emergencies, such as the terror attacks of 9/11 in 2001 and Hurricane Katrina in 2005. These events also inspired the Risk Assessment Methodology for Water Utilities (RAM-W); wider adoption of the “all hazards” planning approach, focused on building capacities and capabilities to address a broad range of emergencies; the creation of the nonprofit Water Information Sharing and Analysis Center (WaterISAC), which promotes the exchange of security information; and the creation of Water/Wastewater Agency Response Networks (WARNs), pre-established agreements among utilities that enable them to rapidly provide mutual aid during emergencies. Ever since, several experts have warned that a pandemic could be the next major threat for the water industry (AWWA, 2003; Hughes, 2006; Lacey, 2006; Van Atta and Newsad, 2009). Indeed, COVID-19 has presented challenges unlike any other in recent history and should prompt new or revised policies and solutions for the water sector, building on the policies in place.

Table 1 lists the seven policy statements plus the EPA policy in chronological order of adoption and each is discussed in the following sections.

3.1. AWWA and ASCE policy statements

3.1.1. AWWA policy statement on electric power reliability for public water supply and wastewater utilities (1975)

Although focused on the role of power supply, this early AWWA policy statement, first adopted in 1975, addresses the importance of continuous service under any circumstance: “Avoiding extended interruptions in water service is essential for protecting public health, fire safety, local economies, and the environment. ... Every water and wastewater utility should set uninterrupted service as an operating goal” (AWWA, 2014).

Most U.S. water and wastewater systems depend entirely on power supplied by the electric grid (Sowby and Burian, 2017; Chini and Stillwell, 2018). This is one example of the water–energy nexus and its interdependencies. On-site or mobile (trailer) generators and elevated water storage can extend water service during a power failure, even if only temporarily and at a reduced level, so water systems should develop or enhance that capacity. They should also establish protocols to quickly notify customers to shed nonessential water uses, like landscape irrigation, in order to extend the system’s stored water supplies during a power outage. Power utilities, too, are updating their emergency plans for pandemic scenarios in a context that also envisions widespread electrification (Walton, 2020).

3.1.2. ASCE policy statement 348: Emergency plans for water supply (1989)

In 1989, ASCE established a policy that stresses water supply continuity, based initially on concerns about droughts and then expanded to include other emergencies. It calls for “the development of emergency plans by ... water providers to prevent or minimize the disruption of water service to residences, businesses, and government during emergencies. Emergency plans must be developed to minimize the risk of water supply disruption due to any cause, whether naturally occurring or man-made. ... Specific vulnerabilities in maintaining services during emergencies should be identified in existing water systems and incorporated into emergency plans” (ASCE, 2018a).

The approach speaks to the value of diversifying water portfolios (i.e., not relying too much on one water source or type of water source) and of establishing emergency interties among neighboring water systems to continue service when a particular water source is down. Further, existing water supplies can be extended by long-term demand management or short-term restrictions, making for a relevant synergy of water efficiency and emergency preparedness.

3.1.3. AWWA policy statement on public involvement and customer communication (1993)

Communication is particularly important during emergencies to maintain the confidence of both customers and employees. This policy statement, introduced in 1993, observes, “The credibility and reputation of utilities and the water profession as a whole are supported by open and ongoing communication that establishes relationships and creates a framework for understanding, trust, and cooperation, especially in times of crisis” (AWWA, 2018c).

As COVID-19 began to spread in the U.S., many wondered if the virus was waterborne and if their drinking water was compromised. Water utilities needed to quickly dispel both fears and assure customers that their water was safe and reliable. Water utilities also needed to communicate with essential employees to keep their systems running, which is especially challenging in a pandemic when employees cannot gather all in one place and need to coordinate shifts and responsibilities by other means. AWWA recently published Trending in an Instant: A Risk Communication Guide for Water Utilities (AWWA, 2019). Its appearance
just weeks before COVID-19 was nothing short of prescient as water professionals sought guidance on how to communicate during a pandemic.

3.1.4. ASCE policy statement 499: Emergency preparedness and response (2003)

This ASCE policy, adopted in 2003, directly responds to the “vulnerabilities of the nation’s infrastructure to terrorist attacks and other events” that were apparent after 9/11. It addresses more generally the role of civil engineers in emergency preparedness. It supports “comprehensive planning, education, and training initiatives that increase the ability and readiness of civil engineers to quickly and effectively respond to all events that impact the nation’s physical infrastructure.” [These efforts] should be immediately incorporated into emergency response planning and implementation” (ASCE, 2018b).

As states were rapidly shutting down to slow the spread of COVID-19 and the definition of “essential businesses” was being debated, ASCE acted on this policy. In a letter dated 2 April 2020, ASCE petitioned governors to designate engineering as an essential service. Licensed engineers, the letter argued, have a “moral obligation to hold paramount the safety, health, and welfare of all individuals” but cannot fulfill that obligation when their planning, design, construction, and oversight activities for critical infrastructure are restricted. In the future, such designations should be clear before emergencies in order to allow infrastructure and utilities to keep operating.

3.1.5. ASCE policy statement 500: Resilient infrastructure (2003)

Like the earlier one, this ASCE policy was adopted in 2003 to address the infrastructure vulnerabilities made apparent after 9/11 and has since expanded to cover all risks and more general resilience. It encourages “initiatives that increase resilience of infrastructure against man-made and natural hazards” and calls for minimum performance standards. Further, “an all-hazards, comprehensive risk assessment, including recovery and return to service, should be incorporated into planning, design, construction, operation, and maintenance activities for infrastructure components” (ASCE, 2017b). Related ASCE policy statements are those supporting unified definitions (ASCE, 2013) and research (ASCE, 2017a) for infrastructure resilience.

Infrastructure resilience has come a long way in recent years thanks both to research of the fundamental concepts and to observations of how infrastructure responds to disruptions like earthquakes and hurricanes. Still, a pandemic presents different resilience challenges than other events in terms of scale, acuteness, duration, and recovery, not to mention the economic and social complications (Hughes, 2006; Van Atta and Newsad, 2009; McDonald et al., 2018). Until now, the resilience of modern infrastructure has not been field-tested by a pandemic. As such, infrastructure resilience, already a popular research and policy subject, could benefit from further attention to pandemic scenarios.

3.1.6. AWWA policy statement on emergency preparedness and security (2006)

In 2006 AWWA established a policy that emphasizes the critical function of water services and encourages interagency cooperation, stating that “emergency preparedness and security are of paramount importance to the reliable delivery of safe drinking water, the protection of public health, and the safety of the professionals responsible for water systems ... Utilities that provide water or wastewater services are encouraged to integrate emergency preparedness and security into their culture, including, but not limited to, establishing partnerships with state, provincial, county, [and] local public health, law enforcement, and other emergency-response entities” (AWWA, 2015). Like ASCE’s policies, it encourages an all-hazards approach, following guidelines from federal agencies.

AWWA publishes a manual of practice on the subject, Emergency Planning for Water and Wastewater Utilities: M19 (AWWA, 2018a) and a management standard, AWWA G440-17: Emergency Preparedness Practices (AWWA, 2017). The Water Environment Federation (WEF) has a similar guide focused on wastewater, Emergency Planning, Response, and Recovery (WEF, 2013). AWWA also offers guidance on cybersecurity, which has been a growing threat and is particularly important when operating water systems remotely (Germano, 2019; West Yoast Associates, 2019).

3.1.7. AWWA policy statement on cash reserves (2018)

Water and wastewater utilities need to be financially resilient as well as physically resilient, able to handle fluctuations in cash flow due to unplanned repairs, changes in water use, and prolonged emergencies (AWWA, 2018d). One of AWWA’s newest policy statements, approved in 2018, speaks to the need for water utilities to maintain cash reserves: “Utilities should establish cash reserve policies ... [that] consider operational and capital risks, level of risk tolerance, any governing financial requirements, future capital funding requirements, revenue volatility, and other ways to manage or mitigate financial risks” (AWWA, 2018b). Maintaining one to three months of reserves is recommended (AWWA, 2018d). Reserve requirements may also be set by lenders or other entities.

In the wake of COVID-19, the U.S. will see unemployment rates comparable to those of the Great Depression (Wolffers, 2020; Cohen, 2020). As a result of sudden unemployment or other factors associated with COVID-19, many ratepayers are unable to pay their water bills. Aware of their essential role in public health, many water utilities are not disconnecting water services for nonpayment (either by choice or by compliance), but the move threatens their financial stability. A recent report by Rafelis (2020) estimated an annualized $13.9 billion shortfall for U.S. drinking water utilities due to delayed payments, unemployment, reduced non-residential sales, and slower customer growth. Cash reserves can help water utilities ride out these disruptions.

3.2. EPA risk and resilience assessments and emergency response plans (2018)

From the perspective of water and wastewater utilities, policy statements by professional associations are helpful but ultimately voluntary. They guide public policy, but cannot establish or enforce it. In contrast, a set of provisions in America’s Water Infrastructure Act of 2018 (AWIA) constitutes enforceable law and is such as is a significant step forward for emergency preparedness in the water sector.

Responding to the terror attacks of 9/11 and the anthrax attacks that soon followed, Congress passed the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, known commonly as the Bioterrorism Act (U.S. Congress, 2002). Title IV of the act addressed drinking water specifically, requiring some water systems to complete a vulnerability assessment and emergency response plan. It also directed a review of methods to prevent, detect, and mitigate water supply disruptions and contamination events.

In 2018, AWIA superseded or enhanced these requirements. The new act passed nearly unanimously and signals Congress’s awareness of and commitment to water resources. Section 1433 of the Safe Drinking Water Act (42 U.S.C. 300t-2) and, like its predecessor, directs community water systems serving more than 3300 people to complete a risk and resilience assessment (RRA) and an emergency response plan (ERP) to “obviate or significantly lessen the impact” of a disaster and keep their services running (U.S. Congress, 2018; EPA, 2020b). AWIA goes beyond previous requirements to address water system resilience more broadly.

The assessment must consider risks stemming from malevolent acts and natural hazards, as well as the resilience of water system infrastructure and operations, including cybersecurity. Based on the findings of the assessment, the emergency response plan must describe strategies, resources, actions, and procedures to prepare for and respond to incidents that threaten life, property, or the environment. The EPA, which oversees compliance, offers an online Vulnerability Self Assessment Tool
(VSAT) for this purpose, as well as other resources to help water utilities prepare and comply (EPA, 2020a). The EPA also encourages utilities to conduct tabletop emergency preparedness exercises as part of their planning (EPA, 2018).

For large water utilities (serving more than 100,000 people), the risk and resilience assessments were due in March 2020; others are due in December 2020 (50,000 to 99,999 people) and June 2021 (3300 to 49,999 people). The emergency response plans are due six months thereafter. Whether developing their plans for the first time or updating them at the prescribed five-year interval, water utilities should consider lessons learned from the COVID-19 experience. They should also be aware of the federal financial resources, as enumerated by Brodmerkel et al. (2020), that are available to help U.S. water utilities mitigate and recover from disasters; the newly required assessments may justify further investments.

While the AWWA requirements are specific to drinking water utilities serving more than 3300 people, wastewater utilities could benefit from the same level of preparation, as could smaller water systems in an adapted form.

4. A need for comprehensive planning

Due to the interdependent nature of water, power, telecommunications, and transportation systems, there is a risk of cascading and simultaneous failures (Buldyrev et al., 2010; Vespignani, 2010; Wolter et al., 2010; Sitzenfrei et al., 2011; Ouyang, 2014; McDonald et al., 2018; Mitsova et al., 2020). Water and wastewater utilities should consider these possibilities when developing their emergency preparedness plans.

To cite a recent example, a 5.7 magnitude earthquake struck Salt Lake City, Utah, on the morning of 18 March 2020, at the same time the community had already deployed its emergency resources to fight back the rising tide of COVID-19 (Scribner, 2020; Reavy, 2020; O’Donoghue, 2020). The 5.7 magnitude quake—the largest in Utah since 1992—damaged numerous buildings, grounded flights, halted rail transit, and left 32,000 people without power for several hours. Water infrastructure was also affected: in personal communications with the author, several local water utilities reported water main breaks, SCADA communication losses, and inoperable facilities. This is just one example of how one emergency (COVID-19) becomes the background for another (earthquake), underscoring the need for utilities to plan for multiple and simultaneous contingencies.

Accordingly, COVID-19 may prompt discussion on whether more comprehensive emergency preparedness or resilience regulations are necessary at the local, state, or federal levels. While not explored here, such regulations may involve coordination among public safety departments, drinking water and wastewater regulators, and state public utility commissions.

One particular area for improvement is tabletop exercises with pandemic scenarios specific to water utilities, which appear to be underutilized (Hughes, 2006; Van Atta and Newssad, 2009; EPA, 2018). Just months before COVID-19 broke out, U.S. federal agencies finished a series of exercises whose sobering results “drove home just how underfunded, underprepared, and uncoordinated the federal government would be for a life-or-death battle with a virus for which no treatment existed” (Sanger et al., 2020). Water leaders voiced similar warnings earlier (Lacey, 2006; Hughes, 2006; Van Atta and Newssad, 2009). Water, wastewater, and other utilities could benefit from targetted tabletop scenarios with new insight from COVID-19 to identify weaknesses and strategize preparedness solutions.

5. Conclusions

Water and wastewater utilities provide essential services at all times and must be able to ensure continuity through disruptions and emergencies. COVID-19, with its unprecedented impacts across multiple service sectors, renews and elevates the importance of emergency preparedness for water and wastewater utilities. Fortunately, there is no need to start from scratch, as considerable policy guidance and resources already exist. If new, more comprehensive emergency preparedness policies or regulations are warranted, the policies reviewed here are a starting point. Water and wastewater utilities should build on these resources and apply the lessons learned and perspectives gained from their COVID-19 experience in order to strengthen their preparedness for the future.

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