Are Small Community Water Systems MORE AT RISK than Other Systems?

By **Stephen Gasteyer**,
Department of Sociology, Michigan State University
With assistance from **Dandan Kong**,
Department of Sociology, Michigan State University

Graphic Design by **Jamie Bouquot**

A growing chorus in the U.S. maintains that community water systems are in desperate need of attention. As long ago as 2000, *Water Online* stated, "The 54,000 drinking water systems and 16,000 wastewater systems in the United States face staggering infrastructure funding needs of nearly $1 trillion over the next 20 years and shortfall of a half of a trillion dollars, according to Clean and Safe Water for the 21st Century. [T]he Water Infrastructure Network (WIN) [estimates] that [while] America's drinking water and wastewater systems spend $23 billion per year for infrastructure, they face an annual shortfall of another $23 billion to replace aging facilities and comply with existing and future federal water regulations."

The media reports dramatic anecdotes and statistics focusing on urban water infrastructure problems. According to *U.S. Water News*, for instance, the Detroit Water and Sewer Authority in 2002 estimated 35 billion gallons of lost water, meaning that customers paid $25 million for water that never reached its intended destination. Shrinking population and miles of abandoned housing and industrial space exacerbate Detroit's situation. Nationally, the American Society for Civil Engineers has estimated that water systems lose 17 percent of treated water through leaky pipes, or some 2.6 trillion gallons of water per year. A *New York Times* front page article on water infrastructure challenges in March 2010, depicted a water main break in the "fashionable Dupont Circle neighborhood" of Washington, D.C. and reported that "a significant water line bursts on average every two minutes somewhere in the country… in Washington alone there is a pipe break every day, on average."

Small Systems Also Face Challenges

Infrastructure problems are not just big city problems. A water operator in a smaller Michigan community recently told me, "At this point we don't even try to replace old pipes because there isn't the money; we have our hands full just fixing the breaks." Small community water systems may well be in more dire straits than larger systems. Discussions with small community water operators and consultants point to several systematic disadvantages and challenges. Small systems lack the economies of scale of larger systems and thus are unable to cover the costs of treatment upgrades and infrastructure repairs and replacements through marginal rate increases spread over many customers.

Because of this, small community systems are more challenged in meeting maximum contaminant level requirements, such as the more stringent arsenic standards implemented in the last decade, or other regulatory burdens. Beyond the number of rate payers, small communities have fewer financial options. Low population is often accompanied by lack of commercial revenue streams for many small communities, meaning that they are unable to obtain good bond ratings to finance water infrastructure projects.

This situation has deteriorated in the last two decades with the steady decline of rural manufacturing. The dilapidated downtown has become iconic for small towns in many parts of the country. Those who work with small community systems note that small community water operators are often underpaid, and lack the necessary skills to address new demands from regulatory changes and emerging water treatment and distribution challenges. Further, small community water boards are often lambasted as lacking the interest and skills to properly manage their systems, and often simply try to minimize water rates at the expense of long-term viability.

Further, new industries that are held out as a promise for revitalization of small communities, such as biofuel or bioenergy processing plants, may bring new challenges for small community systems. These industries frequently have high water use and effluent treatment demands. Without proper planning, these attributes could lead to unforeseen expenses for communities, both in terms of new infrastructure and treatment capacity and the need to upgrade the skill level of water operators—all problematic given the list of problems mentioned above.

Illinois Survey Yields Interesting Results

While there is broad agreement that these issues exist among community consultants and small system water operators themselves, very few statistics exist to verify or refute these assertions. With funding from the Midwest Technical Assistance Center and the U.S. Department of Agriculture, we conducted a survey of water operators in 2007. The survey was sent to all registered supervising operators (1,184) for community water systems in the state of Illinois.

A total of 474 operators responded to the survey, and 471 returned surveys sufficiently valid for inclusion in our analysis (a response rate of approximately 40 percent). Operators were asked to give background on their water systems and communities, including: community population, system size, source of water, system ownership, water system health, water system capacity, as well as their level of operator training, amount of time dedicated, and the salary they received. Illinois provides a good benchmark: According to the U.S. Census, the state falls in the median on most of the critical demographic variables (age distribution, household income, educational attainment, etc.), making it an ideal for gauging national trends.

The distribution of responses is comparable to the community water system size distribution for Illinois. It is notable that the returned surveys over-represent the smallest categories of water systems, and under-represent mid-sized systems (those between 10,000 and 100,000). Because there are only nine community water systems for communities of more than 100,000, it is not surprising that we received only a couple of responses from operators at Illinois' largest utilities. The distribution of water system size is relatively similar to the national distribution. (See Table 1 for comparison.)

The differences on key questions are summarized in Table 2. Analysis of the survey responses indicates that size matters: but much more so in terms of long-term capacity than for many of the indicators that we often associate with day-to-day system capacity. For example, when we asked how operators felt about their water systems, both those from systems of less than 500 and those with more than 10,000 connections were most likely to say their water systems were in good shape. It may well be that the operators of the smallest systems simply didn't recognize looming problems. But there is no way to know that from this data. Likewise, there was no discernable pattern when we asked operators to opine about whether water rates covered costs. In all size categories of less than

10,000, approximately 20 percent felt that rates did not cover costs, and 25 percent of those representing systems of more than 10,000 felt the same way. Again, it is possible to interpret this as a sign of low capacity, as small systems may simply not have understood the extent to which their system was in difficult financial straits. This could explain some of the other responses.

When we asked for more objective indicators of capacity, a more definite pattern emerged. Systems of greater than 10,000 connections were significantly less likely to have been cited with violations in the last two years. Systems of fewer than 500 hookups were significantly more likely than systems in all other size categories to have had water quality violations over the last two years. Systems of less than 500 connections were also the most likely not to have raised their rates in the last three years.

The only question where we find a reverse trend is in the area of management. When we asked whether the community water system board or committee met on a regular basis, as a key indicator of management capacity, small system operators actually ranked their systems better than operators from all other size categories – with only 18 percent, versus 25 percent for systems of greater than 10,000 hookups saying that the water board did not meet regularly. This does not say anything about actual board deliberations or decisions, but it does at least indicate that someone on the board felt the position was important enough to warrant regular meetings.

On the other hand, small systems were in a much more precarious situation regarding the human aspects of operational capacity. Analysis indicates a consistent inverse relationship between water system size and indicators of operator capacity. Operators from small systems were, on average, older, less trained, and more poorly paid than those representing larger systems. While it is not surprising, it is somewhat alarming that 85 percent of operators of very small systems made less than $40,000 annually, and 65 percent of these operators were older than 50 years of age at the time of the survey. This bodes poorly for the ability to hire new operators as Baby Boomers retire.

Challenges Ahead

The upshot is that many of the assertions of those working with small community water systems were confirmed by the results of this survey. Small systems are, indeed, more likely to be in violation of water regulations, and more likely not to be raising rates on an annual basis to avoid what has been called "rate shock" when water systems try to address long term problems.

One of the most important findings is that the water industry-wide workforce crisis may well be more severe in small systems. Indeed, small systems in Illinois have both the oldest and lowest paid water operators. It may be that the key to sustainably

TABLE 1: DISTRIBUTION OF WATER SYSTEMS BY SIZE

	Respondent Frequency	Respondent Percent	Illinois Percent	U.S. Percent
Fewer than 500 connections	188	39.9	36	56
501 to 3,300 connections	196	41.6	39.1	27
3,301 to 10,000 connections	66	14.2	12.6	9
10,001 to 100,000 connections	21	4.2	12	7
>100,000	2	0.4	0.5	1
Total	471	100	100.1	99

TABLE 2: WATER CAPACITY BY SYSTEM SIZE

Percent of Respondents that:	<500	501-1500	1,501-3,300	3,300-10,000	>10,001
Rate Their Water System as Not Healthy	27.4	33.8	36.6	38.5	25
Say Water Systems Cited for Violations in Last 2 Years*	31.7	22.1	19	26.2	5
Say Rates Have Not Been Raised in the Last Three Years*	41.8	31.8	36.8	29.7	15
Say Rates Do Not Cover Costs	22.3	19.7	20.3	23.4	25
Report Average Operator Pay < $40,000**	85.1	52.3	29.3	4.9	0
Report Average Operator Age >50 **	65.8	56.3	55	53.8	55
Report Water Board Does Not Meet Regularly	18.6	22.9	20.9	22.6	25

* Indicates that this relationship was significant with a P value of .05.
** Indicates that the statistical difference was significant with a P-value of .01 or below.

providing safe water throughout the state—and in other parts of the country—will be in helping those community water boards that meet on a regular basis to understand the importance of investing in human capital, in the form of operators, as well as physical infrastructure.

Acknowledgements: *Thanks to the Midwest Technical Assistance Center, the Hatch Fund of the U.S. Department of Agriculture, and the University of Illinois Agricultural Experiment Station and the Michigan State University Department of Sociology Startup Fund for providing the resources to carry out and analyze these findings. The authors extend a special thanks to Anne Silvis and Steve Wilson for their assistance in moving this project forward.*

References

American Water Works Association. 2004. *Avoiding Rate Shock: Making the Case for Water Rates.* Denver: AWWA.

Duhigg, Charles. 2010. "Toxic Waters: Saving U.S. Water and Sewer Systems Would be Costly." *New York Times*, p. A1 (March 14).

Hollands, Bruce. 2010. "The Underground Infrastructure Crisis: Rebuilding Water and Sewer Systems without a Flood of Red Ink." Issue Brief #176, (January 18) Accessed at: *www.ntu.org/news-and-issues/transportation-infrastructure/ntuib176undergroundinfrastructurecrisis.pdf.*

Water Online. 2000. "America's Drinking Water, Wastewater Systems in Desperate Need of Funding." (April 20).

Formerly the Director of Policy Development and Applied Research with the Rural Community Assistance Partnership, **Stephen Gasteyer** is an assistant professor in the Sociology Department at Michigan State University (MSU).

Dandan Kong is a graduate student in the MSU Sociology Department, research rural community environmental issues.