

DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES

## Creating a Comprehensive Data Set of Private Wells and Well Vulnerability in New York

Ursula Lauper, MA, MPH  
 Martin Zartarian, MS  
 Chelsea Hogan  
 Braden Savage  
 David Dziewulski, PhD  
 New York State Department of Health

**Editor's Note:** NEHA strives to provide up-to-date and relevant information on environmental health and to build partnerships in the profession. In pursuit of these goals, we feature this column on environmental health services from the Centers for Disease Control and Prevention (CDC) in every issue of the Journal.

In these columns, authors from CDC's Water, Food, and Environmental Health Services Branch, as well as guest authors, will share insights and information about environmental health programs, trends, issues, and resources. The conclusions in these columns are those of the author(s) and do not necessarily represent the official position of CDC.

The authors are research scientists in the Bureau of Water Supply Protection at the New York State Department of Health (NYSDOH). Ursula Lauper is the principal investigator of the CDC-funded NYSDOH Safe Water for Community Health (Safe WATCH) cooperative agreement. David Dziewulski is the water systems control and analysis section chief.

Many states struggle with the lack of data on water sources and drinking water systems that are not regulated by the Safe Drinking Water Act (SDWA). In the U.S., most unregulated systems are private wells. While New York regulations provide additional coverage for non-SDWA regulated wells with 5–14 service connections and fewer than 25 users, an estimated 1 million sites serving approximately 4 million residents across the state rely on unregulated private wells for their potable water. Systems not regulated by SDWA do not have consistent operation, monitoring, or reporting requirements and have not been thoroughly evaluated for their potential to contribute to the occurrence of waterborne disease. There is currently an information gap among pri-

ate well users about possible harmful exposures or hazards, vulnerabilities of the water sources to contamination, treatment, and assessment of health outcomes.

Considering these issues and with funding from the Centers for Disease Control and Prevention's (CDC) Safe Water for Community Health (Safe WATCH) Program, the New York State Department of Health (NYSDOH) set about to create a more comprehensive private well data set that includes relevant, colocated vulnerabilities. Since 2000, the New York State Department of Environmental Conservation (NYSDEC) has required that all well drillers obtain a certificate of registration. As of December 2016, NYSDEC listed 107,415 wells in their well drilling log database. This list was revised from an ini-

tial count of 82,472 using the 668,683 private water sources listed in the New York State Office of Real Property Tax Services (ORPS) database. Most updates corrected locational data, including adding latitude/longitude values and removing wells outside of the state. While most of the unregulated water sources and systems in the ORPS data set are likely private wells, data are not differentiated between wells and sources such as springs, lakes, and streams. All points in the ORPS data set were listed as centroids of property parcels and data were unavailable for 12 counties. The NYSDEC data set also had some limitations in that it included only wells drilled since the beginning of 2000 and data for five counties were missing. Nonetheless, the 107,415 NYSDEC wells and 688,683 ORPS unregulated water sources maps show similar distributions and concentrations of wells susceptible to flooding (Figure 1). Linking these data sets allowed us to take advantage of the strengths of each while mitigating their individual weaknesses.

Next, we updated the GIS layers for floodplains in New York by consolidating multiple sources to cover 87% of the state. These sources included the Federal Emergency Management Agency's national flood hazard layer (the most accurate data source that covered only 35% of the state) and additional flood hazard layers from the New York State Office of Information Technology Services and NYSDEC. Eight counties had no flood zone data and a ninth had only partial data. The number of wells and unregulated water sources located in a flood zone was 2,483 (2.3%) in the NYSDEC data set and 30,502 (4.6%) in the ORPS data set. The updated and expanded floodplain map layer, GIS lay-

ers, and database were built to show well locations in 100- and 500-year floodplains.

Karst geology and proximity to concentrated animal feeding operations (CAFOs) were also included in the mapping because flooding-related risks are elevated in these areas (Figure 2). According to NYSDEC, New York has approximately 500 CAFOs, the majority of which are dairy farms with 300 cows and associated livestock operations. We requested the CAFO map layer from NYSDEC and obtained the karst geology map layer from the U.S Geological Survey.

Vulnerable wells were identified when the hydrogeology of a specific site was known. In the absence of specific information, buffers were created extending different lengths from

the center of each CAFO to capture inventory of nearby water wells, taking into consideration the special features of karst zones (e.g., porosity and surface recharge areas that exist over long distances). In the karst zones, we placed 2-mi buffers around each CAFO with 300 cows and a 1-mi buffer around each CAFO with <300 cows. In the non-karst zone, 1-mi and 0.2-mi buffers were created for larger and smaller CAFOs, respectively. For CAFOs straddling a karst zone, the radius was extended when the buffer zone of a CAFO in a non-karst zone reached a karst zone and reduced the length when a karst zone CAFO reached a non-karst zone. Using these GIS map layers, the number of NYSDEC vulnerable wells and ORPS vulnerable unregulated

water sources were again mapped by county and a strong agreement between the data sets was again demonstrated. These findings indicate that private wells in areas where karst geology and CAFOs overlap are more vulnerable to contamination during flooding events.

Creating this linkage of data sources and types has significantly improved the understanding of well distribution and vulnerability across the state. To date, these integrated data sets have been used to identify vulnerable wells during flooding and manure spillage events, to select study populations for surveys and pilot sampling programs, and to target outreach and education efforts. New data sets, such as updated county-level source water survey results, will be added as they become available to further enhance NYSDOH's ability to anticipate and respond to the public health needs of private well users.

