# Water Security Test Bed

## *Research tool can bolster municipal water security*

*The WSTB can be used for research related to detecting and decontaminating chemical, biological or radiological agents following an intentional or natural disaster.*


People use water every day to meet domestic, industrial, agricultural, medical and recreational needs. Yet Americans often take for granted the availability of clean, safe water, which is crucial for the nation's health and prosperity.

To help ensure our water security, the U.S. Environmental Protection Agency built the Water Security Test Bed (WSTB) at Idaho National Laboratory to improve America's ability to safeguard our water systems, and to respond to contamination incidents and natural disasters.

Research at the WSTB will help develop methods for decontaminating pipes and equipment and designing a better, more resilient infrastructure. A community with disrupted water for any amount of time is going to feel the pain, from both health and economic perspectives.

For example, when a tank at Freedom Industries in Charleston, West Virginia, leaked 7,500 gallons of methylcyclohexane methanol (a chemical used in cleaning coal) into the nearby Elk River in January 2014, up to 400,000 people in nine counties were without access to potable water for several days. Industries that relied on clean water, such as the food and beverage industry, were also affected.

### *Real-life conditions, controlled environment*

The WSTB can be used for research related to detecting and decontaminating chemical, biological or radiological agents following an intentional or natural disaster. Because water systems are becoming more automated, scientists

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are adding a cybersecurity research element to the WSTB to support a better, more secure infrastructure.

Research at the WSTB takes place at INL's Critical Infrastructure Test Range Complex. The test bed area measures 600 feet by 300 feet and uses 8-inch ductile iron pipe that is more than 40 years old—recovered from a decommissioned INL facility.

The test bed has been constructed to replicate real-life conditions in a controlled environment. The cement-mortar lined iron pipe used in the WSTB is typical of the type of pipe found in a U.S. city. On the inside it may have biofilm, mineral deposits and could be corroded where the cement lining has chipped away. These factors are important because old pipe tends to absorb contaminants differently than newer pipe.

All the fittings, valves, hydrants, sensors and telemetry equipment were assembled from full-sized, off-the-shelf commercial products to simulate conditions within existing drinking water utilities. As the WSTB evolves, a new water service line is being connected to a room in an adjacent building to simulate water use in a bathroom, kitchen and laundry facility.

### *Research scenarios*

One experiment might involve contaminating household appliances with specific pathogens to see what kind of decontamination methods, materials and systems are needed to clean them.


***Researchers are testing elevated concentrations of chlorine and other disinfectants to decontaminate pipes.***

Researchers could also model what would happen if terrorists launched a cyberattack that spoofs water quality sensors, thereby giving false water quality data to water infrastructure control systems.

Other research aims to address concerns about crude oil, transported via rail, contaminating waterways. Initial tests are examining contamination persistence and decontamination methods for drinking water infrastructure. Another project analyzed the persistence of contamination in a simulated large municipal system using Bacillus spores that behave much like anthrax but are otherwise relatively benign.

So far, researchers have found that results they saw in pilot-scale tests do not necessarily match results from the full-scale test bed, which further informs research and decontamination recommendations EPA would provide to communities. The research lets EPA actually simulate what could happen in real water infrastructure.

For example, highly corroded pipe can rob a system of the residual chlorine needed to prevent regrowth of bacteria and pathogens. With the pipe system at the test bed all above ground, researchers are testing elevated concentrations of chlorine and other disinfectants to decontaminate the pipes. They are also testing portable treatment units to treat water collected in a 28,000-gallon lagoon built adjacent to the pipes.

### *What's next*

The first test bed experiments were completed in September and October 2014. Additional experiments were executed in May through September 2015. EPA and INL are planning new experiments using the current setup, and they have additional excavated water pipe to expand the system's configuration. They are seeking collaboration with other federal partners and water sector researchers and would like to design the next phase of the WSTB to meet collaborators' needs.

### *For more information*

***Mike Carpenter***
*WSTB Program Manager*
*208-526-8467*
*michael.carpenter@inl.gov*

***Nicole Stricker***
*Communications*
*208-526-5955*
*nicole.stricker@inl.gov*

**A U.S. Department of Energy National Laboratory**