

It Takes a Village to Test Your Water

A new EPA Homeland Security Center

By Jeff Harrison



Karen Josephson

One of the Water Village's four ordinary houses (above) features monitoring equipment such as the plumbing system shown at right. Extensive plumbing has been installed for hot/cold water, distilled water and gray water as well as electrical conduit for data and power lines.



Karen Josephson

Researchers at The University of Arizona in Tucson are developing a laboratory facility that will test new technologies designed to monitor the safety and aesthetics of the nation's water supply. Much of the impetus for the UA "Water Village" comes from a substantial grant awarded by the Office of Homeland Security and the Environmental Protection Agency. The grant includes researchers at several other universities who are working on water-related issues.

The grant creates an EPA Homeland Security Center, specifically the Center for the Advancement of Microbial Risk Assessment (CAMRA) at the UA and six other schools: Michigan State University, Northern Arizona University, University of California, Berkeley, University of Michigan, Drexel University and Carnegie Mellon University. The heart of the UA's effort will be the "Water Village," a unique facility geared to test new technology.

On the outside, the Water Village looks like four otherwise unremarkable houses located on the grounds of the university's venerable Environmental Research Laboratory (ERL). Inside, the houses are a labyrinth of pipes, fiber optics and monitoring equipment. Researchers expect the village will become the premier testing facility for securing the nation's water supply in three key areas: safety, health and aesthetics.

"It's a platform to deal with emerging issues in water quality," says Charles Gerba, a UA professor of soil, water

and environmental sciences and one of three principal investigators on the grant. Gerba and fellow professor Ian Pepper, who heads the UA/National Science Foundation Water Quality Center, hatched the idea for the Water Village while flying back to Tucson from a conference. Pepper, one of the three UA investigators on the grant, said the concept for the project came together when he and Gerba realized that the UA and ERL had the all of the scientific and engineering expertise in-house to create it.

Researchers expect the village will become the premier testing facility for securing the nation's water supply in three key areas: safety, health and aesthetics.

The first house, nearly finished, is designed for point-of-entry testing for water coming inside a building. The second house will be for experiments on how contaminants — either natural, accidental or deliberate — might enter and move through the water supply. The third house will look at the aesthetics of water — taste and odor. The fourth building will be for public education. ERL hosts public tours each month and the village will become a conspicuous part of those.

The project evolved from a modest beginning. Gerba, nationally known for his studies on germ-laden surfaces in homes and offices, initially received \$10,000, one of several

small investigative grants from the UA Office of the Vice President for Research, to look at homeland security issues.

He and Christopher Choi, the third PI on CAMRA and an associate professor of agriculture and biosystems engineering at the UA, also are collaborating on a grant from the Defense Advanced Research Projects Agency (DARPA) to look at microbes in sewer systems.

“The real challenge in the 21st century is to continue delivering safe water to the tap,” Gerba said. Treatment plants have guidelines for producing safe water, but the big ‘I don’t know’ is the distribution system, and very little has been studied about how water quality degrades through distribution system, especially in your own home.

“The water quality at the source may have nothing to do with the water quality at the tap,” Gerba said. “The idea is to understand the performance of the system and how to better protect it and the public.”

Arizona also has the largest number of drinking water systems that do not use a disinfectant. Most of those systems draw ground water from wells. Private wells also are not regulated.

“There’s no requirement to treat ground water in the U.S. for drinking water,” Gerba said. “It’s a glaring problem. Two kids in Arizona died several years ago after swimming in water that wasn’t disinfected.”

As the number of older Americans continues to rise, so does the risk of contracting an illness from drinking water. Seventy percent of the deaths from diarrhea in this country are people age 55 and older. Pregnant mothers and those with compromised immune systems also are at risk.

The whole point of the Water Village is having a facility that is somewhere between a laboratory and the real world. Lab testing relies on carefully controlled experiments in an ideal setting.

“There’s no requirement to treat ground water in the U.S. for drinking water,” Gerba said. “It’s a glaring problem. Two kids in Arizona died several years ago after swimming in water that wasn’t disinfected.”



Karen Josephson

A laboratory sink in one of the test homes is fitted with nine water outlets for simultaneous testing and evaluation of water purification devices and other point-of-use technology.

“You can do some things in a laboratory, but at the other end of the scale there are some things that you cannot do out in the community,” said Pepper, an expert in ground water pathogens. “You cannot deliberately put contaminants into peoples’ distribution systems. This is an intermediate field-scale testing facility, with a closed loop where we can look at the fate and transport of chemical and biological contaminants.”

The facility will help researchers understand how a biological or chemical contaminant might travel through a real neighborhood or building where the water utility wouldn’t immediately know how it entered, or how it might travel as people downstream open their taps, take showers or flush their toilets.

“The hardest question is knowing where to look,” said Gerba. “The second question is how do we clean it up. The third is how clean is clean. We can use this facility to examine emerging technologies for contaminant detection and control in a simulated real-world situation. That’s what is unique about it.”

Also unique is the center’s education component. Graduate microbiology students will be trained here to produce the next generation of microbial risk assessment scientists.

The facility will help researchers understand how a biological or chemical contaminant might travel through a real neighborhood or building where the water utility wouldn’t immediately know how it entered, or how it might travel as people downstream open their taps, take showers or flush their toilets.

The UA Water Village is part of the first, and so far the only, EPA and Homeland Security center of its kind. The UA Water Quality Center, based at the ERL, also is the National Science Foundation’s only center for studying water quality.

ERL has for 30 years showcased water and environmental technology adapted for arid lands. Its scientists have worked on Disney World’s EPCOT Center, on shrimp and fish hatcheries, and on seawater-irrigated agricultural crops throughout the world, to name a few.

In addition to the Office of Homeland Security/EPA grant, worth \$10 million over the next five years, the Water Village project has garnered funding from Arizona’s Proposition 301 revenues, the UA College of Agriculture and Life Sciences, the Office of the Vice President for Research, and a number of corporations. ✨

CONTACT

Charles Gerba
520-621-6906
gerba@ag.arizona.edu

Ian Pepper
520-626-3328
ipepper@ag.arizona.edu

Christopher Choi
520-621-1890
cchoi@ag.arizona.edu