Geoscientists Without Borders, BGC Engineering and IsraAID Project in Uganda Has Success with GEL EC CFU Kits in the Field

Paul Bauman Geophysics provides geophysical equipment in support of humanitarian exploration efforts. https://www.paulbaumangeophysics.com/

Project and Problem

A foundational assumption to borehole repair and drilling programs is groundwater from a borehole is healthier and safer than water from a spring. Hydrogeologists are typically taught that the ground surface, particularly clays, protect against the infiltration of animal and human waste into groundwater. The standard belief is the earth acts as a filter, removing toxic contaminants along the groundwater flow path, including dangerous bacteria.

In a Geoscientists Without Borders (GWB) sponsored project in Northern Uganda, geoscientists from BGC Engineering's humanitarian foundation BGC Squared, partnering with the NGO IsraAID, wanted to see if this is actually true in rural village environments in Northern Uganda: Is a clear African stream less safe than a rusty, old hand pump where cows, goats and chickens are gathered? Is a hillside spring a greater threat to human health than a hand pump where women are collecting water, washing clothes and cleaning pots?

Rather than assume rural African groundwater is safe and surface water is unsafe, Paul Bauman of BGC and Selda Edris of IsraAID wanted to test various water sources for bacteria. However, rural, remote areas in Uganda have no electricity, incubators, or labs. It is difficult to transport chemicals in these settings or to filter samples, and some water quality tests require unreasonably strict hygiene requirements for handling samples in the field. His team needed a simple testing method optimized for field testing in low resource areas.

Solution

BGC's Principal Geophysicist and Hydrogeologist, Paul Bauman, created a team including geoscientists from BGC Engineering and the WASH lead from IsraAID. Funding was provided by Geoscientists Without Borders, Kingston-North Kitsap Rotary Club, BGC Engineering, and Paul Bauman Geophysics. Selda Edris of IsraAID recommended Bauman use the Aquagenx GEL EC CFU Kit to test for *E. coli*. It is a 100 mL field test that generates Colony Forming Units (CFU) without membrane filtration equipment. GEL Kit components only include plastic bags and packets of Aquagenx growth media.

Water was tested at each hand pump repair site, including a few of the repair and new well sites from Bauman's 2018 Geoscientists Without Borders and IsraAID program. In all the Ugandan sites where villages lack a well and are reliant entirely on springs or rivers for drinking water, Bauman also collected surface water samples for *E. coli* testing. Samples were taken from nine springs, each of which serves as the main water source for a community.

Test Results

All nine springs had high to extremely high CFU counts, with eight of the springs having counts greater than 30 CFU/100 mL, and four of the springs having counts greater than 100 CFU/100 mL. Most of the communities dependent on springs as their primary drinking water source complained of diarrhea, typhoid and cholera. Of the 11 hand pumps that were sampled, all had CFU counts of 4 CFU/100 mL or less, with four having CFU counts of 0 CFU/100 mL. The message is clear: from a microbial perspective, groundwater is safer than surface water.

Conclusion

"The Aquagenx GEL Kit enables CFU testing for *E. coli* where it was previously impossible in rural, low resource areas," says Paul Bauman. "It is advantageous for field testing because it requires no incubation, no filtering, no electricity, no difficult-to-transport chemicals, no media preparation or multiple pieces of equipment. The GEL Kit is relatively simple to implement."

Bauman continues, "The Aquagenx GEL EC CFU Kit is a game-changer. I'm impressed with how well they work and with the test results. In our Uganda project, the GEL Kit definitively and unambiguously demonstrated that groundwater is safer than surface water and spring water. These kits will be a regular part of any similar program I carry out in the future."

Images courtesy of Paul Bauman