

Engineers provide operator training for the new arsenic treatment system.



Arsenic Free in Argentina

By Esmeralda Bonilla

San Antonio de Los Cobres, a community of 6,000 residents in the Andes Mountains in Argentina, faced a challenging arsenic concentration of up to 290 ppb in its water supply. It needed a solution to reduce the level to below the maximum contaminant level set by the World Health Organization (WHO) of 10 ppb.

Remote Andean town reduces arsenic with new treatment system

Health Risks

The greatest threat to public health from arsenic comes from drinking water contaminated with arsenic. Arsenic poisoning, or arsenicosis, characteristically occurs over a period of five to 20 years. According to WHO, this exposure is associated with several chronic effects, such as skin problems, skin cancer, cancers of the bladder, kidney and lungs, and diseases of the blood vessels of the legs and feet.

It is possible that arsenic exposure also causes diabetes, hypertension, reproductive disorders and impairment of intellectual development in children, but these effects have not yet been tested. Arsenic does not impart taste or color to water, so people consuming contaminated water will not realize the risk.

The San Antonio de los Cobres community has a history of higher-than-normal incidences of cancer, heart failure and other health issues. In 2006, His Heart Missions, a nonprofit organization dedicated to international community service projects, contacted AdEdge Water Technologies LLC to design and build an arsenic treatment system to augment the existing water treatment system to reduce arsenic concentrations to less than 10 ppb.

into a series of cisterns. The existing pretreatment was able to reduce approximately 25% to 30% of the arsenic content in the water, but could not reach the 10-ppb level recommended by WHO.

The process was completed with a new second-stage arsenic treatment system supplied by AdEdge. From the cisterns, an underground pipe brings the pretreated water to the new treatment system before it is distributed to the community.

The system consists of a two-step process to remove arsenic using coagulation filtration followed by a polishing step with adsorption technology. The two treatment units are manually operated and capable of treating a flow rate of up to 200 gal per minute (gpm). Currently the plant is operating at a maximum flow rate of 150 gpm, providing approximately 39 gal of treated water per person per day.

A New Treatment System

The first step of the process utilizes ADGS+ filtration media with the aid of iron augmentation. ADGS+ is a silica-based media with a hybrid manganese dioxide component. This technology efficiently co-precipitates and removes arsenic from water as it passes through the fixed media bed.

The process utilizes a continuous feed of an existing sodium hypochlorite injection and a new ferric chloride addition to achieve the designed treatment goals. Both the sodium hypochlorite and ferric chloride are injected far enough ahead of the filters to allow the chemicals to mix with the raw water and have adequate contact time to oxidize arsenic, iron and manganese.

The sodium hypochlorite is fed prior to injection of the ferric chloride to oxidize any arsenic (III) to arsenic (V) for optimal removal. Oxidized precipitated arsenic, iron and manganese are removed in the bed, which is then backwashed out of the filters.

The ferric chloride typically requires 30 seconds to 2 minutes of contact time before the water contacts the media in the filters. This process allows significantly higher filtration flow rates per square foot of media (5.1 gpm per sq ft), less backwash water than other conventional approaches, and a smaller footprint, which means lower capital and operating costs. The filtration media is backwashed approximately three times

Existing Treatment

The drinking water supply of San Antonio de los Cobres consists of raw water intake from a spring source located about 3 miles from the water treatment plant. The untreated water contains arsenic levels of up to 290 ppb. This information, from November 2011, corresponds to lab results provided by Aguas del Norte, a water utility that operates the water treatment plant.

Prior to the installation of the arsenic treatment system, the water was pretreated by coagulation filtration with the addition of ferric chloride passing through a series of sand filters. The pretreated water then flowed



The remote town of 6,000 people has high rates of diseases that could be the result of exposure to high levels of arsenic in drinking water.

per week, is simple to use, has a long life of 10 to 15 years, does not impart any harmful residuals or odor, and is certified by NSF Intl. for use in drinking water applications.

The coagulation filtration unit consists of two 60-in.-diameter-by-60-in.-tall carbon vessels in parallel configuration, including flow control valves, flowmeter, pressure gauges and sample ports. The unit receives influent water with arsenic concentrations of approximately 220 ppb and produces pretreated effluent water with arsenic concentrations of 11 ppb.

Pretreated water from the coagulation filtration unit enters a polishing process with adsorption technology utilizing GFO+ granular ferric oxide adsorptive-based media. The media has a high capacity for arsenic and is delivered in a dry, non-crystalline form. It is robust and easy to handle, is stored and shipped dry, and has received NSF approval for use in drinking water systems under Standard 61.

The adsorption treatment system consists of two 54-in.-diameter-by-60-in.-tall carbon steel tanks in parallel configuration. This unit also includes flow control valves, flowmeter, pressure gauges and sample ports. The unit polishes the pretreated water, reducing arsenic levels from 11 ppb to less than 5 ppb. Both treatment systems are modular and manually operated to accommodate the design flow of 200 gpm.

An Arsenic-Free Community

In November 2011, AdEdge engineers traveled to San Antonio de los Cobres to start up the system and train locals in the operation and maintenance of the new filtration plant. On Nov. 5, 2011, at approximately 9 p.m., arsenic-free water flowed down the pipeline for the first time to every man, woman and child in this remote Andean town.

Since startup, water quality test results show the system is operating successfully and reducing arsenic levels to less than 5 ppb. Helping Hands For Water, a 501(c)(3) nonprofit organization started by a group of AdEdge employees, coordinated the logistics and communication between AdEdge, His Heart Missions, Aguas del Norte and the San Antonio de los Cobres municipality.

The superintendent of San Antonio de Los Cobres presented His Heart Missions and AdEdge an official

declaration of thanks and recognition of the significance of the arsenic treatment system donation in providing a better quality of life for the citizens in his community. *wqp*

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