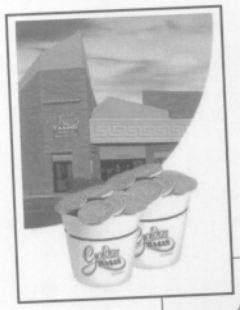
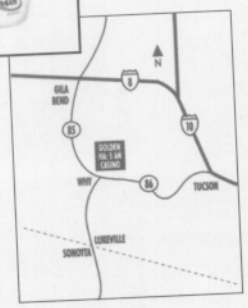
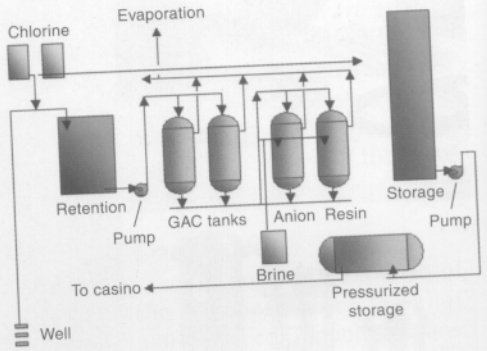
ARSENIC IN THE OLD WEST:

The Tribe said 'Why?' and the USEPA said 'Why not?'







By C.F. "Chubb" Michaud, CWS-VI

Summary: *When an Arizona Indian tribe decided to open a gambling casino in the mid-'90s, water potability became a big concern. Arsenic in the groundwater was identified as a major obstacle. With some ingenuity and low-cost alternatives, the casino has been successful in keeping the water in a healthy state.*

Situated 120 miles southwest of Tucson, Ariz., on Highway 86, the town of Why sits unimposing against a backdrop of mesas and desert flora. When the Tohono O'odham, a Native American tribe indigenous to Arizona, was granted permission to build a small casino called the Golden Ha:san back in 1995 on its tribal lands there, they were elated. They had the resources, the land, the labor, a need for a boost in the local economy and—perhaps most importantly—they had the water lying under the desert floor.

It lies just north of the Organ Pipe Cactus National Monument and adjacent to the Cabeza Prieta National Wildlife Refuge. A well on the property produced adequate flow to handle the casino, a bar, a restaurant and a convenience store. Then it hit. The only source of well water for the area was found to contain nearly 12 parts per million (ppm) of arsenic—more than 240 times the existing 50 parts per billion (ppb) standard and over 1,000 times the U.S. Environmental Protection Agency (USEPA)-proposed (and soon to be enforced) 10 ppb limit.

Arsenic is ubiquitous to the soil. Most groundwater contains some, usually between 0 and 10 ppb while others contain >50ppb. Rarely do we see >100 ppb of arsenic from an uncontaminated natural source. Yet, Mother Nature had "blessed" this arid desert area with millenniums of runoff water concentrations. What to do? Coordinated through the casino's technical operations in Tucson, the tribe contacted Frank Borowski of Aqua Tech, which has since been acquired by the local Culligan dealership. He supplied a system designed for a continuous 20 gallons per minute (gpm) water supply that proved to be just what the doctor ordered.

Adding chlorine

The original water analysis didn't speciate the arsenic concentration as to As-III and As-V. Since the water was for potable use anyway, it was decided to chlorinate the well water and disinfect it at the same time to oxidize the As-III into As-V, making it more easily removable. The chlorinator was activated by the well pump, which in turn was activated by a float switch in a 5,000-gallon retention tank. Chlorine was supplied from a 50-gallon, 0.25-percent solution supply tank located in a nearby utility shed. High local temperatures often exceeding 110°F in summer months dissipate the active chlorine rapidly so this tank was made up two to three times per week. The chlorine feed to the well was maintained at a residual of 1 to 2 ppm as it went to the storage tank. The 5,000-gallon storage provided a minimum of four hours retention before repressurizing and being sent to the filtration system. A food-grade, strong base anion (SBA) resin was selected for the anion exchange and a bank of granular activated carbon (GAC) filters removed the excess chlorine prior to the SBA. Twin GAC filters (10 cubic feet each) ran in parallel and backwashed (with treated water) every other day (on alternating days) with the backwash water used for irrigation of nearby green belts.

After dechlorination, the water proceeded to twin alternating SBA filters (10 cubic feet each) with each metered to run 20,000 gallons and regenerate 100 pounds of sodium chloride (NaCl) while the regenerant waste was held for evaporation. The water was then re-chlorinated to 0.5 ppm residual from a 50-gallon, 0.1-percent solution chlorine supply tank and stored in a 28,000-gallon supply tank, which controlled the operation of the repressurization system from the well retention tank. An additional pump supplied water from the storage tank to a 1,500-gallon pressure tank, which then supplied the nearby casino and other facilities. Spot checks of casino taps indicated a chlorine residual of 0.3 to 0.5 ppm.

Staying on course

Wayne Chino, who works out of Tucson, is currently the project coordinator for the casino, which oversees the Why operations. He said they continue to sample the treated water twice monthly and typically see their levels of arsenic come back in the range of 0.190 to 0.029 ppm. Although higher numbers were seen when they forgot to check prechlorination levels (this confirms the presence of As-III), they've remained in compliance with the USEPA guidelines ever since the startup of the filter in 1996. Chino is very proud of that.

Even though dropping the As-V levels from 12 to 0.02 ppm represents a 99.8 percent arsenic reduction and complies with the current 50 ppb USEPA maximum contaminant level (MCL), some work has to be done before the new MCL comes into effect at 10 ppb in 2006. Chino is confident it can be accomplished because levels that low have been hit before. Paying a little more attention to the chlorine feed will bring them down to that level. Converting the SBA system to upflow regenration will easily get them there as well. In addition, new and emerging technologies for arsenic removal—such as specialized filtration media—could improve the performance of this system and reduce the stress on the resins to extend their working life.

Conclusion

The Desert Diamond Casino was able to handle its very severe arsenic problem without breaking the bank. This was one of Frank Borowski's last projects. He passed away in April 1998. This article, written by the co-designer of the plant, is dedicated to his memory and technical skills.

About the author

♦ *Chubb Michaud, CWS-VI, earned bachelor's and master's degrees in chemical engineering from the University of Maine and has more than 30 years of professional experience in water and fluid treatment processes. He is the technical director of Systematix Co., which he founded in 1982. Michaud is also a founding member of the WC&P Technical Review Committee. He can be reached at (714) 522-5453, (714) 522-5443 (fax) or email: cmichaud@systematixusa.com*