

# Reducing Costs for Reducing Arsenic

By Brian Donda

Developing less  
expensive POE  
systems for  
arsenic treatment

**“A**rsenic Found in Groundwater.” How many times have you seen that headline? There is no doubt that arsenic has become a common household term, used not only by teenagers studying the periodic table but also by adults who have long forgotten their high school chemistry classes.

In the last 10 years, arsenic has made headlines for various reasons. Most deal with human exposure and its associated risks.

Arsenic is present in natural deposits in the earth. It can enter drinking water supplies from these deposits or from agricultural and industrial activities.

Because arsenic is odorless and tasteless, many consumers do not worry about arsenic as a contaminant. However, as noted on the U.S. Environmental Protection Agency’s website, “Non-cancer effects can

include thickening and discoloration of the skin, stomach pain, nausea, vomiting, diarrhea, numbness in hands and feet, partial paralysis and blindness. Arsenic has been linked to cancer of the bladder, lungs, skin, kidney, nasal passages, liver and prostate.” If arsenic is present in a water source, it should be treated seriously.

## Consumer Savvy

As consumers become savvier about contaminants, it is increasingly important to certify drinking water treatment equipment for any and all reduction claims. While consumers likely do not fully understand certification, the water filtration aisles of retail stores, such as Wal-Mart or the Home Depot, are packed with boxes covered with certification logos. The fact is, consumers do understand the difference between products that carry certification marks and ones that do not. In a world where more is better, those marks carry a lot of weight.

Point-of-entry (POE) and point-of-use (POU) arsenic reduction systems have been around for many years. Most commonly, reverse osmosis (RO) systems have been tested and certified for arsenic reduction. A handful of other media-based products, however, also are tested and certified for arsenic reduction.

While RO is effective, a problem lies in getting RO-treated water to all taps in a house. The most common RO units typically do not run at flow rates to support a whole-house application, and systems that are capable of handling those applications often are not affordable for the average consumer.

## Specialized Media

To provide a more feasible means of reducing arsenic, media manufacturers have taken the initiative to develop specialized media that can reduce arsenic in water. A common use for this media is the large-system market.

Municipalities ensure that the water they provide to consumers is as close to arsenic-free as possible. Some of the more common types of treatment

they use are coagulation/filtration (also known as flocculation), iron oxide adsorption, electro dialysis (also known as electro dialysis reversal) and ion exchange. In addition, many manufacturers now are tailoring their media for residential applications.

POU products are most commonly available for residential use to reduce arsenic contamination. However, for those who live in areas where arsenic contamination is an issue, a POU system would not provide treated water throughout the home; it would only provide reduction at the one tap to which it is connected.

To further complicate the issue, some homes rely on private wells. Therefore, the only option is a POE system, which offers a great choice for complete assurance that all consumable water is treated to reduce arsenic. It comes at a high price, however.

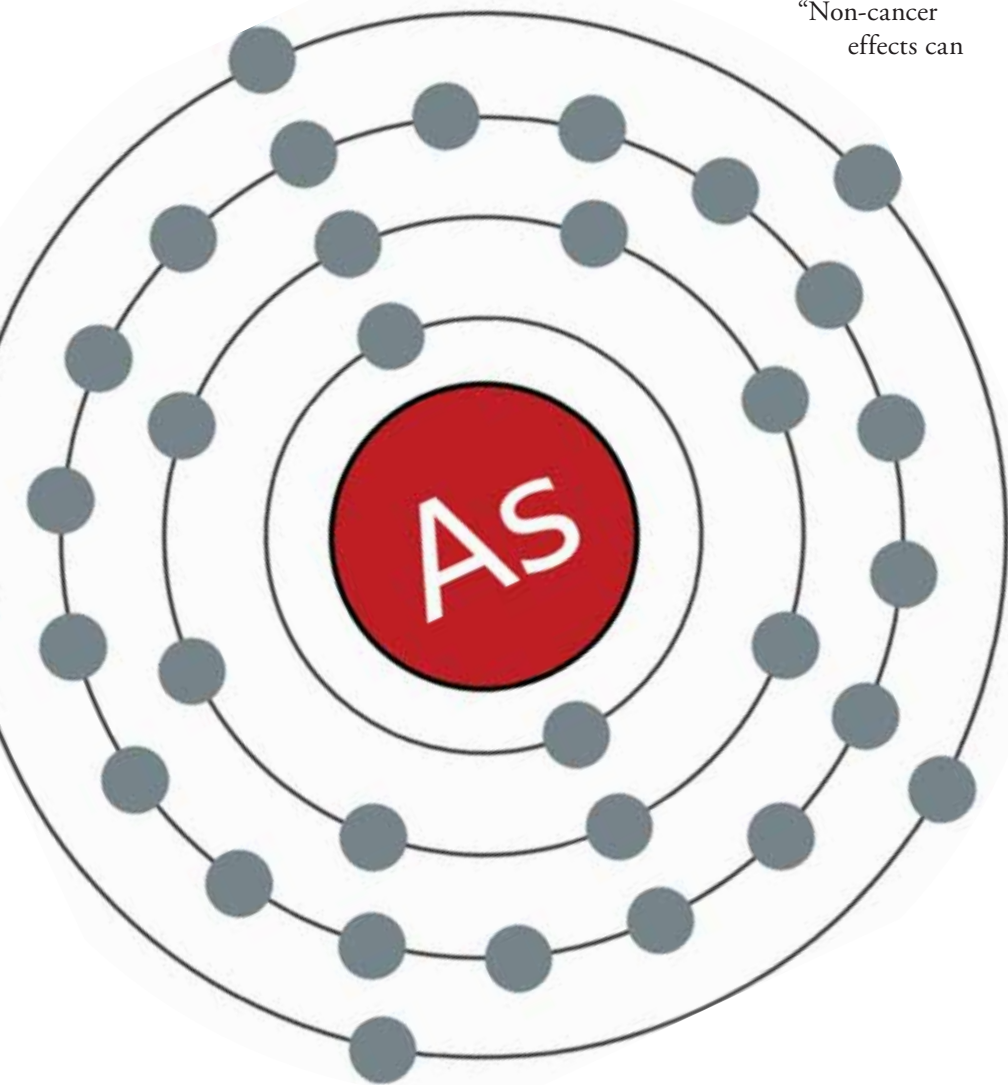
## System Economics

The problem both manufacturers and consumers face is the economics behind manufacturing, testing and purchasing/selling a POE filtration system that can reduce arsenic. In order to have a POE system tested and certified to NSF/ANSI Standard 53, there are several things to consider.

Arsenic occurs in two forms: pentavalent and trivalent. Depending on the water source, arsenic may be present in either or both forms. Furthermore, due to the variability of arsenic levels in water, the standard allows manufacturers to choose between an influent challenge of either 0.3 mg/L or 0.05 mg/L.

In either case, the allowable effluent level is 0.01 mg/L in product water. The standard also requires that arsenic reduction testing be conducted with water at pH levels of both 6.5 and 8.5.

Typically, trivalent arsenic is more difficult to remove; however, it can be converted to pentavalent arsenic. To facilitate the conversion, detectable free chlorine residual must be present. When an oxidant such as free chlorine is present, it can effectively convert trivalent arsenic to the pentavalent form.



Even though this conversion is possible, and testing only for pentavalent arsenic is acceptable, the most marketable system would be tested for both forms. To do so would require a total of four reduction tests to be performed: trivalent at 6.5 pH, trivalent at 8.5 pH, pentavalent at 6.5 pH and pentavalent at 8.5 pH.

Beyond the number of tests, increased costs are incurred because the testing is for a health claim. When a system is tested for a health claim, it is tested to either 120% of product life (if the system has a performance indicator) or 200% of product life (if the system does not have a performance indicator).

In addition, because arsenic reduction systems usually are constructed with an exhaustive media and are used for whole-house applications in which significant amounts of water are flushed down toilets or used for dish or clothes washing, their capacities are typically upwards of 50,000 to 100,000 gal. These two facts mean that the system will be required to be tested for 60,000 to 200,000 gal.

A test with that much water could run for months, depending on the flow rate used. Any test that takes months to run will increase the cost of the test significantly, compared to POU testing that may last only for a few days to a few weeks.

### Good News

The good news is that there is a task group working toward the goal of finding a way to allow more systems to enter the market by performing the certification challenge testing in a more economical manner. The group has been working on different testing protocols that would provide a significant reduction in the amount of water and the number of days the test runs. It is assumed that these theories and concepts will be transferable to many health claims in addition to arsenic.

Certified POU residential water treatment systems with the ability to reduce arsenic or other health claims are common and affordable. Certified POE systems with the same capabilities are few and far between.

Costs that are incurred when attempting to obtain certification are substantial. Hope is on the way to alleviate some of the financial burden in getting these types of whole-house systems certified.

At this time, POE options for the reduction of arsenic are severely

limited. Due to the high costs of testing, the Water Quality Assn. has certified only one family of whole-house systems that have the capability of reducing arsenic. *wqp*

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