



Water.
Process.
Solutions.

Arsenic Removal

Case Study for the County of Madera, California

Challenge

At Madera County's Rolling Hills Water Treatment Plant, increasing arsenic levels in Well #3 to above the EPA MCL of 10 ppb resulted in the County having to take this well out of service. Limited alternative water sources meant that the County often had to impose water restrictions on the local community previously served by this well.

Solution

In order to be able to utilize this water resource again, the County selected treatment using oxidation/coagulation followed by pressure filtration to reduce arsenic levels to below the EPA MCL.

The most prevalent forms of arsenic found in groundwater are the pentavalent arsenate ion ($\text{As}[\text{V}]$) and the trivalent arsenite ion ($\text{As}[\text{III}]$). $\text{As}[\text{III}]$ is easily oxidized to $\text{As}[\text{V}]$ with chlorine and other oxidants. Ferric chloride reacts with water and forms $\text{Fe}(\text{OH})_3$, which strongly adsorbs the $\text{As}[\text{V}]$. The final iron-arsenate complex that is formed is insoluble and can be removed from solution by filtration with filter media such as Greensand™. This process of oxidation/coagulation/filtration is very similar to standard iron/manganese removal filters, fully automated and relatively simple to operate.



Arsenic levels have consistently been reduced from 11-15 ppb to less than the county's target of 8 ppb.

Solution continued . . .

This process was selected over adsorptive media processes due to lower operating costs where the media does not require periodic replacement and disposal in a hazardous waste facility as well as a preference by the Californian Department of Public Health to use this technology for Arsenic removal applications. As this facility was located at an unmanned site, it was also important to the County that the process was low maintenance and only required periodic visits by an operator. A key part of the County's system design was a backwash water recovery system that allows precipitated arsenic that is backwashed off the filter media to settle in a backwash recovery tank, while supernatant is recycled to the head of the plant. Since there is no sewer available at the site for backwash water disposal, any residuals have to be hauled off-site and it is important to keep the residual volume to a minimum.



Results

Wigen was selected to supply the Arsenic Removal System in 2011 and performed a short pilot study to confirm the design parameters as shown in the below table.

Operational Characteristics

Service Flow Rate:	500 gpm
Filter Sizing:	(3) 84" dia. x 60" Side Shell
Service Loading Rate:	4.33 gpm / ft ² of media area
Filter Media:	Greensand with Anthracite Cap
Backwash Rate:	12 gpm / ft ² of media area
Backwash Recycle Tank Volume:	25,000 gallons
Backwash Volume:	17,500 gal per backwash (for 3 filters)

Following start-up, arsenic levels have consistently been reduced from 11-15 ppb to less than the county's target of 8 ppb, allowing the County to use this water supply and relieve the water supply stresses for the local community.



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