

Pollard Industries; Arsenic Removal



SUMMARY OF SOLUTION FOR ARSENIC REMOVAL FROM GROUNDWATER

We have created a solution that economically meets the discharge parameters of 2 ppb arsenic from a contaminated groundwater treatment process that contains between 50 and 1,000 ppb of arsenic. Depending on the number of wells in operation, the resultant stream ranged between 50 and 200 ppb of arsenic with a flow of 60 to 90 GPM. Local permitting required that the arsenic on discharge be less than 2 ppb.

Oxidation was employed to control the valence of the arsenic and the iron found in the water sources. Multimedia and softening was used to remove solids and the hardness found in the well sources. A reverse osmosis unit was employed to concentrate the arsenic to a level sufficiently high enough to effectively precipitate the arsenic. As a safe guard, an anion ion exchange column was placed on the reverse osmosis filtrate to remove any arsenic that passes through the membrane. Regeneration of the column was based on the loading a sulfates, found in the RO filtrate. The 80% volume discharge of the groundwater stream always tested Non-Detectable for arsenic.

Backwash from the multimedia, regeneration from the softener and ion exchange column, and the reject from the reverse osmosis system were combined and chemically pretreated. The effective waste stream averaged less than 25% of the total groundwater flow, with an arsenic level of greater than 500 ppb. The chemical pretreatment consisted of a two-step reaction which adjusted pH and added a ferrous compound to aid in the formation of an insoluble ferro-arsenate molecule. The pretreated stream was then directed to a microfiltration system which rejects all particles greater than 0.2 micron. A standard filter press dewatered the ferro-arsenate sludge. Tests conducted on the filtrate of the microfiltration showed an average discharge of 3 to 4 ppb.

The discharge of the microfiltration and the reverse osmosis system were combined and pH adjusted to meet the discharge requirements. The combined discharge of 80% reverse osmosis and 20% microfiltration filtrate maintained an average arsenic level of less than 0.5 ppb arsenic.

BENEFITS

The arsenic removal system is economical. The method described allows high volumes of water to be treated. Instead of applying massive amount of chemistry to precipitate arsenic, 85-90% of the stream is treated without pretreatment chemistry.

Oxidation can be accomplished with air scrubber towers, ozone, permanganate or peroxide. Air scrubber towers are easy to operate, require no chemicals, and require no pretreatment. All other oxidation techniques are expensive, regulated and may actually harm reverse osmosis membranes.

Overall, the benefits of this treatment extend into drinking water systems as well.

- Production of a discharge stream that has less than 2 ppb of arsenic.
- A discharge stream that has been softened. Calcium, magnesium and other hardness contributing compounds are removed by the precipitation reaction of the microfiltration system.
- A discharge stream that has less than 0.1 ppm of residual iron.
- Since the inlet arsenic level is concentrated by a factor of 10 and the arsenic is oxidized, the ferrous addition rate is reduced. This results in a smaller sludge generation.
- The entire stream is treated with membranes that block all bacteria and cysts. This reduces the downstream chlorination requirements for household water use.

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