Arsenic Treatment of Groundwater

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Background

The City of Cerritos faces potential fines due to recent changes in regulations of arsenic (As) concentrations in discharged water. The levels of As(III) and As(V), which currently measure to be 11 ppb and 60 ppb, respectively, must be lowered to a total arsenic level of 10 ppb.

Goal

To design a system that efficiently removes arsenic from groundwater pumped from underneath the Cerritos Library Parking Structure.

Design

The arsenic treatment system will consist of an oxidation unit that will convert As III into As V, then two adsorption columns packed with hydrogel media will capture the As V and discharge the effluent into the storm drain.

Figure 1: Cerritos Library www.cerritos.us

Design Constraints

The pump will run continuously with a flow rate of 50 GPM. Periodic maintenance will be required to change the media and for general cleaning. The entire system must be under 200 ft^2.

Critical Cost Elements

- Chlorine Storage Tank
- Oxidation Tank
- Valves and
- Adsorption Columns
- HydroGel Media
- Static Mixer
- Power
- O & M

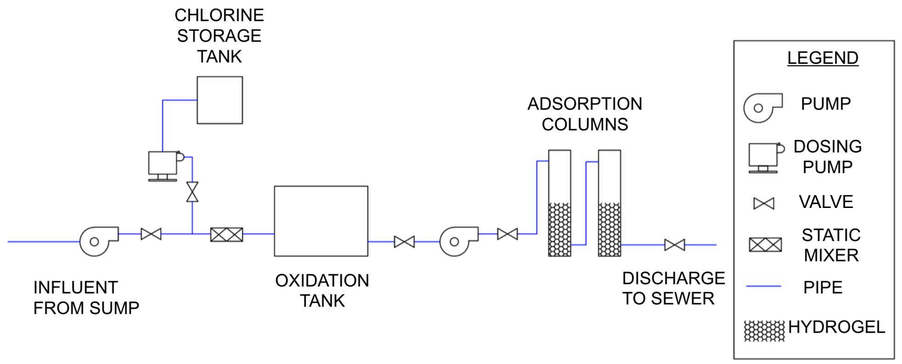

Figure 2: Piping and instrumentation diagram

3 Phase Testing Plan

1. As(III) is more difficult to remove from water than As(V). Chlorine will be used to oxidize As(III) into As(V).
2. The six media types will be tested with the same dosage and contact time. The two medias with highest efficiency will be retested using variable dosage and contact time
3. Filtration columns will be scaled according to the results of Phase 2. Sampled groundwater will be pumped into the columns to establish the breakthrough curves.

Next Phase

1. Size columns
2. Cost Analysis
3. Permitting
4. Efficiency Optimization

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Removal Method Alternatives

*Removal Method	Pros	Cons
Adsorption Media	Low installation costs, Easier to operate	Higher O&M costs, pH dependent
Iron Removal/ Coagulation Flocculation	Lower O&M costs	Moderate installation costs, pH dependent
Ion Exchange	Lower O&M costs, pH independent	Moderate installation costs, Require low TDS/ sulfate and nitrate concentrations
Reverse Osmosis	Removes other contaminants, No oxidation requirements	Inefficient with design flowrate

*Low flow system (<100GPM)

Oxidizing Agent Alternatives

Oxidizing Agent	Pros	Cons
NaOCl (Chlorine)	Inexpensive, Quick, Effective	Trihalomethanes, Leaves a residual
Permanganate	Comparable effectiveness to chlorine	Expensive
Ozone	Extremely efficient, fast	Expensive, Energy intensive, Inefficient in the presence of sulfide
UV	Easy Storage, Reusable, No residual chemicals	Inefficient
Hydrogen Peroxide	Effective	Less accessible than chlorine