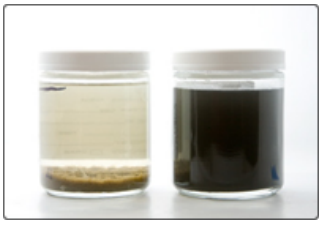
Case Studies

Municiple Water Well Case Study: Use of Chlorine Dioxide to Restore Municipal Potable Water Wells

Municipal Water Wells



Treatment Results

The Issue: Restoration of Municipal Water Wells

The Solution: Treatment with ClO_2

Background

A major Southern California municipality servicing a population of over 100,000 uses potable water source wells to supplement its surface water supply of drinking water. The wells began experiencing high bacteria levels, sulfur odors, and reduced production capacities. The primary problem identified was bacterial fouling and biomass accumulation in the wells. The municipality attempted remedial treatments with sodium hypochlorite and hydrogen peroxide. While initial flow-back results were promising, bacterial contamination levels equivalent to pre-treatment were observed within a few days. Additionally, no improvement was seen in the production capacity of the wells. Some of the wells had experienced up to a seventy percent decline in productivity while retaining the original rest water levels in the well, indicating severe fouling.

Chlorine Dioxide Application Considerations

Chlorine dioxide is an oxidizing biocide that has been used for municipal water disinfection in the United States since the 1940's. It is also used in the food industry as a direct food contact and incidental food additive status sanitizer and disinfectant for the vegetable, meat, dairy, and fresh pack sectors. The benefits for the use of chlorine dioxide in these industries are that chlorine dioxide provides superior penetration into biomass combined with superior microbial kill, while also preventing the formation of undesirable disinfection by-products such as THM's (from chlorine or bleach) and bromates (from ozone or hydrogen peroxide). Based on an evaluation of the municipality's potable water well challenges and the company's experience with chlorine dioxide in these and other industries, Sabre developed a treatment approach.

Chlorine Dioxide Treatment Approach

Chlorine dioxide was applied to the wells in much the same way as had been used for bleach, chlorine and hydrogen peroxide. First the well was pumped down as far as possible with the pump, and then sufficient chlorine dioxide was applied to the well to treat a five-foot radial volume from the water-producing zone at a concentration of 1500 mg/l chlorine dioxide. On wells that demonstrated significant hard water scaling, acetic or citric acid was applied with the chlorine dioxide to help dissolve inorganic carbonate scale deposits. Once the well was loaded with chlorine dioxide, the well casing was displaced to the static water level three times with fresh water containing five milligrams chlorine dioxide to prevent re-contamination of the well. After the wells were displaced, they were shut in for four hours to allow time for the acid to react and the chlorine dioxide to dissipate. The wells were then pumped off for a total of three treatment volumes to a temporary holding tank, and then put back on normal operation once normal pH values and residual oxidants were verified.

Results

A single chlorine dioxide treatment achieved a 100 percent success rate for the sustained elimination of microbial contamination in the wells, as compared to a less than fifty

percent success rate for the alternatives. Additionally, chlorine dioxide-treated wells averaged a recovery rate of 143 percent of original drilled production value compared to 54 percent for alternative technologies.

The Science of Success

Unlike alternative technologies, chlorine dioxide is a true gas that is a relatively stable oxidant, reacting only with reduced compounds such as sulfides, phenols, and biomass. This allows it to penetrate into the formation, kill bacteria, destroy biomass, and oxidize contaminants without forming undesirable by-products. Because chlorine dioxide does not become less soluble in the presence of acids, it can be safely used in conjunction with them to achieve treatment of multi-component matrix damage. As it is a well-established EPA-registered biocide for use in drinking water and food, regulatory considerations are limited to local permitting requirements.

Follow Up

Chlorine dioxide is now used in many states and municipalities for this application in potable municipal water wells, greatly reducing the total cost of operations for these wells and reducing the need for re-drilling or development of new wells.
