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Pre-Filtering Multi Media Systems with Automatic, Self-Cleaning Filters

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Background:
Riviera Water District provides potable water for a small community at *Clear Lake* in Northern California. This lake historically produces significant summer algae blooms and, as a natural lake, has creek sediment runoffs in the winter.

As in many older water treatment plants, a multi media filtration system is used in the production of potable water. The media beds are composed of anthracite, sand and gravel and are the primary filter on the influent and raw water side of the Plant.

The Assessment:
The influent water is surface water which contains many organic types of debris. California canals and lakes can contain high levels of algae, water weeds, crustaceans and other floating debris especially in the summer months. In addition, winter storms and subsequent runoff can easily magnify total suspended solids (TSS) and nephelometric turbidity units (NTU) readings to very high levels.

As a result, these media systems would back flush often, producing a substantial amount of waste or back-flush water. This cleaning method also took the water treatment plant off line in its ability to produce potable water. Due to the high NTU & TSS levels, back-flushing the media filters could not be scheduled often enough to meet the community's water demand. In addition to automatic back flushing, manual "fire hose flushing" was necessary at 10-hour intervals when NTU levels and water demands were high. Additional overtime at the water treatment plant was needed to produce water, significantly increasing costs.

The Prescription:
In Spring/Summer 2005, an automatic, self-cleaning Amiad *SAF 3000* filter was installed as a raw water filter before the media tanks to reduce the loading on the multi media system and allow the media to extend its flushing intervals. The *SAF 3000* pre-filter would hopefully reduce back-wash water, chlorine consumption, and flocculants.

Independent testing was arranged with the *California Department of Health* to help monitor NTU values before and after this automatic filter. TSS levels were sampled and tested at an independent lab. Three interchangeable screens (80, 50 & 25 micron) were also provided for these tests.

The following is a brief description of how the *SAF filter* operates. The water is pumped from the lake into the filter through the inlet flange on the body of the filter as shown in Figure 1 below.

This water first passes through a coarse screen to remove large, hard contaminants that cannot pass through the Suction Scanner nozzles. The dirty water then proceeds through the multi layer cylindrical, 316 stainless steel fine screen (Figure 2).

This 4-layer screen filters the debris from the inside out, causing particulates larger than the filtration degree of the screen to be caught on its internal surface. When a 7 psi pressure differential is reached across the screen due to debris loading, the filter begins its cleaning cycle. The remote controller, which monitors the filter at all times, opens the 2-inch exhaust valve and simultaneously starts the electric drive motor. The suction scanner is a hollow, 316 stainless steel pipe which is connected to the exhaust valve. The opening of this valve connects the inside suction scanner to outside atmosphere. The nozzles on the suction scanner branch from this central tube with openings only a few millimeters from the inside of the fine screen. The differential pressure between the water inside the filter body and atmosphere outside the body of the filter creates high suction forces at the openings of the scanner nozzles. This suction force causes water to flow backward through the screen at very high velocities over a small area at each nozzle. This action pulls off the filter cake from the screen and sends it through the hollow suction scanner pipe and out the flush valve to atmosphere.

This “focused back-flushing” cleans less than 1 square inch of screen area at any one time. The motor drive unit moves the suction scanner linearly across the entire screen area in approximately 20 seconds. This spiral path of the suction scanner is at a fixed speed allowing the filter cake to remain intact for its removal. There is no interruption of system flow downstream of the filter during a cleaning cycle and exhaust or waste water required for flushing is typically less than 1% of the total flow.

The Results:

With influent NTU values between 3 & 7 and TSS levels around 35 ppm, the 80 micron screen at 160 gpm flushed approximately once an hour in March 2005. There was a negligible effect on NTUs, though suspended solids were being removed. The 25 micron screen, while effective, was too small (tight) under these water conditions and would flush every two minutes.

From April through peak algae bloom in August, the 50 micron screen was successfully used in the pre-filter. This screen size back-flushed approximately every 20 minutes with influent NTU ranges from 5-7. Water samples and NTU tests showed reductions of approximately 71% in TSS and an unexpected 26% decrease in NTUs.

In addition, manual “fire hose cleaning” of the multi media system was typically performed every 10 hours under high TSS conditions and large water demands. This manual operation was extended to over 27 hours with the installation of the *SAF 3000* pre-filter.

The *Riviera Water District* has continued to meet California water requirements and has been very pleased with the pre-filtration the Amiad SAF filter provides. Pre-filtration with the Amiad automatic self-cleaning screen filter significantly reduced turbidity (both TSS and NTUs) of influent water with minimal space requirements, energy consumption and water used in back-flushing. The result was cleaner, more efficient operation of the main media filtration system, lower labor requirements, significantly reduced use of chemicals, and much lower release of media filter flush water.

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