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SUPERFUND INNOVATIVE TECHNOLOGY EVALUATION

Demonstration Bulletin

Colloid Polishing Filter Method

Filter Flow Technology, Inc.

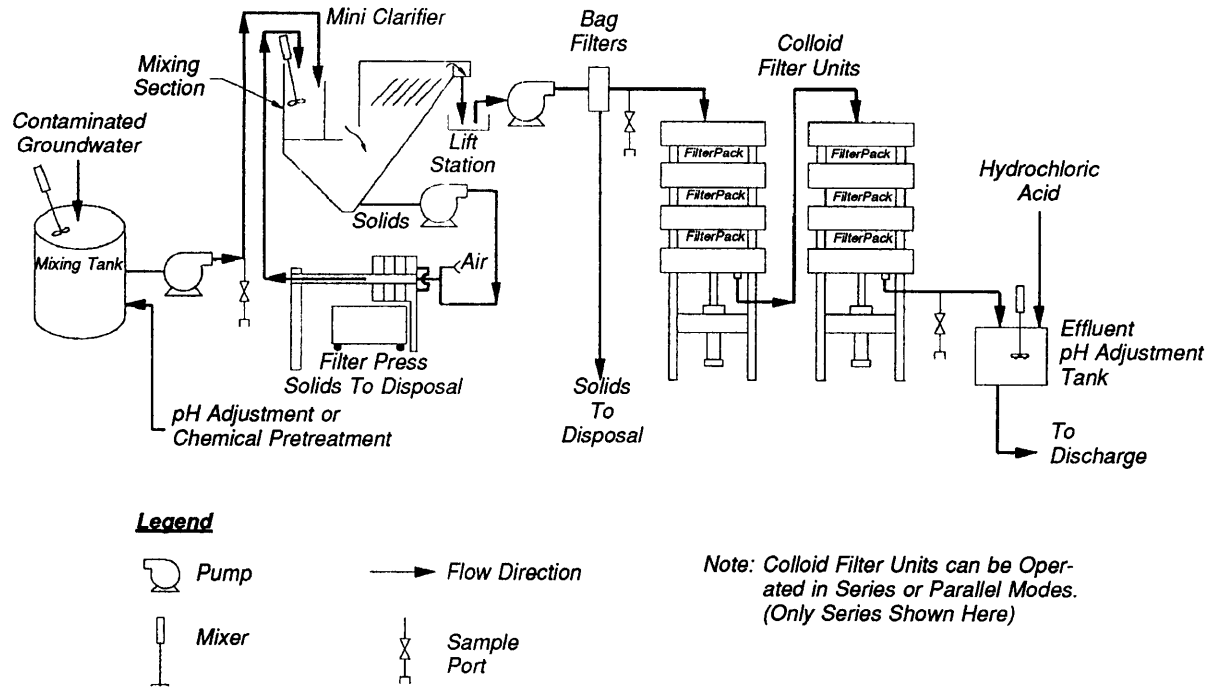
Technology Description: The Filter Flow Technology, Inc. (FFT) Colloid Polishing Filter Method (CPFM) was tested as a transportable, trailer mounted, system that uses sorption and chemical complexing phenomena to remove heavy metals and nontritium radionuclides from water. Contaminated waters can be processed by the CPFM system either as batch (using several thousand gallons/cycle) or continuous (5 to 100-gallon per minute (gpm)) modes.

Contaminated water to be treated by the system is either pretreated to adjust chemical oxidation state and acidity (pH) in mixing tanks or processed directly. After chemical pretreatment, total suspended solids (TSS) are removed in a small, parallel plate separator or mini-clarifier, and bag filters to prolong colloid filter pack life. Effluent from the bag filter is routed to the colloid filter units. Sludge from the mini-clarifier is pumped through a small filter press and the filtered water is returned to the mini-clarifier.

The sorption unit consisted of four horizontal polypropylene filter plates that house three colloid filter packs. Each filter pack contains a proprietary, inorganic, insoluble, oxide-based, filter bed material in particle and bead form. Operationally, the filter packs are pneumatically pressure sealed between each set of plates. The influent contaminated water is evenly dispersed throughout the filter packs where contaminants are removed by sorption, chemical mechanisms, chemical complexing, adsorption, and physical filtration.

Water traversing through the filter packs is collected and directed to a final pH adjustment tank. If necessary, effluent from the colloid filter unit is treated with acid in this tank to reduce the effluent pH to 8.0 to 8.3 before discharge. Once treatment is complete, air blow-down is used to dewater the filter bed, then the hydraulic pressure on the support plates is released, the plates are separated, and the filter packs are removed. Alternatively, the filter media can be regenerated and reused. Spent filter media is then mixed with solids from the mini-clarifier and bag filters and stabilized to meet EPA land disposal restrictions.

Waste Applicability: FFT reports that the CPFM system has effectively removed trace concentrations of colloidal, complexed,



Note: Colloid Filter Units can be Operated in Series or Parallel Modes. (Only Series Shown Here)

Figure 1. *CPFM Treatment System*

chelated, and ionic heavy metals and nontritium radionuclides from water that has been pretreated to reduce TSS. The CPFM system removes a broad spectrum of heavy metal and radionuclide pollutants (excluding tritium) in surface or groundwater, wastewater, or in secondary wastewater generated from soil washing.

Demonstration Approach: The U.S. Department of Energy (DOE) and the EPA formed a cooperative effort to test and demonstrate the CPFM system at Rocky Flats Plant (RFP), Golden, Colorado. The demonstration evaluated the effectiveness of the technology to remove low levels of radionuclides from contaminated groundwater at RFP.

The FFT CPFM technology demonstration at RFP, began on September 13, 1993, and lasted for 3 wk. During the demonstration, approximately 10,000 gal of contaminated groundwater containing about 100 picoCuries per liter (pCi/L) was processed. The groundwater used for the tests had been held in a 500,000 gal storage tank for at least 2 mon and contained heavy algae growth.

Operationally, the demonstration consisted of three tests. The first test consisted of three runs of 4 hr each, treating about 5 gpm. For the second test, also run for 4 hr at 5 gpm, the influent water was treated with sodium sulfide in the pretreatment tanks to change the oxidation state of the radioactive metals in the water. The third test was a 15-hr run, treating water at 5 gpm. The third test was designed to estimate the amount of contamination each filter pack is capable of treating.

During the demonstration, samples of untreated influent, pretreated water after passing through the mini-clarifier and bag filters, and treated water that had passed through the filter packs, were collected, and analyzed for a variety of parameters to evaluate the technology's effectiveness. Adjustment of the influent pH was not required at RFP because the influent water was within the optimum pH range (7.5 to 9) for the technology. Because the pH of the water increased during treatment, the pH of the effluent water was monitored in the final pH adjustment tank and was treated to reduce the pH to influent levels, as required by RFP.

Preliminary Results: Analytical results are expected to demonstrate a significant reduction in heavy metals and radionuclides in the CPFM effluent water. Bench-scale studies using RFP feed water spiked with uranium, radium, plutonium, and americium showed the following results:

Radiochemistry	Influent (pCi/L)	Effluent (pCi/L)	% Removal
Total Uranium	98+12	0.15+0.12	>99
Gross Alpha	166±15	23±6	86
Gross Beta	124±8	57±7	54
Radium-226	13±7	7.4±7	46
Uranium-234	56±10	< 0.03	>99
Uranium-238	35±6	< 0.03	>99
Plutonium-239	7±1	< 0.02	>99
Americium-241	22±4	< 0.01	>99

The SITE evaluation will focus on the ability of the CPFM system to remove uranium and gross alpha contamination from groundwater, due to the low activity of plutonium and americium in the influent. Key findings from the demonstration, including complete analytical results and economic analysis, will be published in a Capsule Report and an Innovative Technology Evaluation Report. These reports may be used to evaluate the CPFM technology as an alternative for cleaning up similar groundwater contamination across the country. Results will also be presented in a videotape.

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