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Potable Re-use of Treated Reclaimed Wastewater

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Potable Re-use of Treated Reclaimed Wastewater

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Many water systems in New Mexico have been severely impacted by the 10-year drought currently occurring in the arid southwest. One of those, Cloudcroft NM, experiences large demand increases on the weekends. Because available water in their fracture formation aquifer has steadily declined, it is often difficult to fill available storage above the 25% level. In addition many of the homes surrounding Cloudcroft now have dry private wells because of the dropping water table. This has forced some citizens on private supplies to rely on the public water system to provide for their needs. In response to the severe drought, the community has instituted severe water rationing, conservation measures, and installed a small surface water treatment plant to treat water that collects in a 1 million gallon firefighting pond. This treatment plant, shown in Figure 1, was the first water treatment facility for the community. The plant consisted of a cationic polymer feed, activated carbon granular media pressure filters, and series of three membrane cartridge filters of progressively finer size to polish the water. These measures have not been sufficient to relieve the drought stress on the aquifer.

Figure 1. Cloudcroft, NM 1-MG firefighting reservoir and surface water treatment plant.

During the midst of this water crisis the community was renovating their wastewater treatment plant. The severe water shortage caused the city to rethink their renovation plans and between phase one and phase two of the wastewater treatment plant renovation, they entered redesign with intent to reuse their wastewater. The intent to reuse coupled with the rapid developments in membrane treatment technologies pushed the selection of membrane bioreactor technology for use in the wastewater treatment plant. This made potable reuse of treated wastewater a technically simple task. The community of Cloudcroft had joined a growing number of Cities in NM that are in progress toward potable re-use. Currently there are 6 cities considering potable reuse: 2 close coupled indirect reuse and 4-aquifer storage and recovery reuse. The American Water Works Association (AWWA) and Water Environment Federation (WEF) have both taken the position that a community should use the highest quality water source available as the potable source. In some areas of the southwest, that is clearly the treated wastewater, and in the case of Cloudcroft, the treated wastewater is a necessary resource in long-term water resource planning during this period of drought.

The proposed purple pipe treatment train for Cloudcroft consists of MBR/chlorination. The proposed potable reuse process treatment train consists of MBR/Chlorination/RO/ chlorination, which is blended with groundwater and surface water from developed springs and then further treated with UF followed by chlorine. The original proposed treatment train is shown in Figure 2. The resulting advanced treated wastewater/water blend, will probably be much safer then the existing potable water, which is untreated chlorinated water from developed springs.

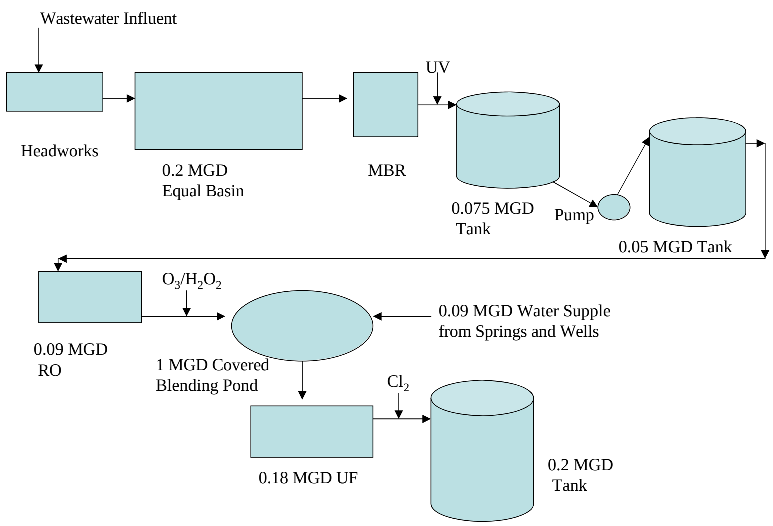

Figure 2. Original proposed potable water reuse treatment train.

The main difference between the final process treatment train and the originally proposed treatment train, is in the MBR and the disinfection steps. It was initially anticipated that the MBR would have microfiltration (MF) as the solid liquid separation process, but the final design ended up with ultrafiltration (UF). All three disinfection steps where changed to chlorination in the final design process scheme both for the sake of simplicity and as the result final design review recommendations by experts. The membranes were purchased prior to letting bids for plant construction. The pre-construction acquisition, membrane equipment was required to be from a single supplier. The membranes were required to have a 10-year replacement warranty. Three bids were received for the membranes equipment. As noted by AWWA, multiple treatment trains were not required because the number of membrane modules provided supplies more then enough redundancy, and any module can be isolated and taken out of service for maintenance or repair. As one would expect, the system is completely computer controlled. This provides a level of protection that cannot be achieved with only operator control since the computer is continually watching the system. The operational control parameter varies depending on the unit of interest. With the MBR the continuously monitored operational variable is turbidity. There is automatic shut down if the treated water turbidity is unacceptable. The MBR system is pressure checked daily, and automatically shut down if the test fails. The membranes are a vacuum, hollow fiber, ultrafiltration (UF) membrane with 0.01μm openings. The operational variable for the RO system is continuously monitored electro conductivity. If EC increases excessively, the system is shut down. The blended RO treated water and untreated surface water is then treated using an ultrafiltration system. This system again uses turbidity as the continuous monitoring parameter. It is important to note that at each step the solid liquid separation process operates using a size exclusion mechanism. The most common failure mode for these processes is to plug and shut off. For both types of unit operations, UF and RO, the continuously monitored control parameter is protecting against the other potential failure mode, which is breach of the membrane. Figure 3 shows details on the UF fiber bundles. Details on the selected system will be given in the presentation.

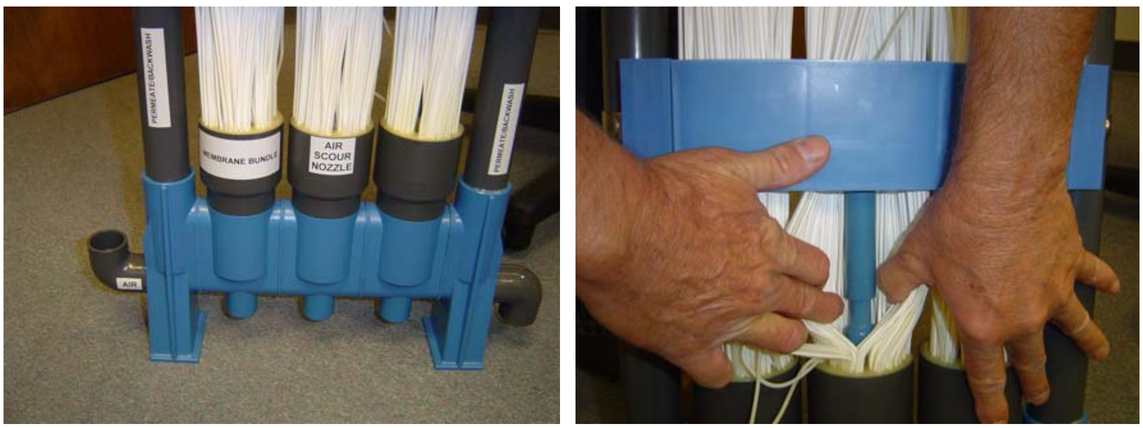

Figure 3. model overview of UF fiber arrangement, and details on fiber.

This system provides exceptional pathogen protection, with a composite “CT” value for this overall treatment system estimated between 12 to 21log removal of pathogens depending on how the estimates are performed. This is compared to the “CT” of 6 required for the worst surface water classification recognized under the Long-Term Enhanced Surface Water Treatment Rule2 under the Safe Drinking Water Act (SDWA). The SDWA does not currently regulate emerging “contaminants of concern”, including hormones, endocrine disruptors, pharmaceuticals, and personal care products. However, in the proposed treatment train, the portion of the wastewater effluent stream to be blended with the raw water source for the potable water system is treated using RO, which has a MW cut off appropriate for salt removal. This provides a comfortable assurance that larger organic molecules will be excluded.

Reference

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