

How does a water & wastewater treatment system work?

Specific treatment processes vary, but a typical wastewater treatment facility process will usually include the following steps:

Coagulation

Coagulation is a process where various chemicals are added to a reaction tank to remove the bulk suspended solids and other various contaminants. This process starts off with an assortment of mixing reactors, typically one or two reactors that add specific chemicals to take out all the finer particles in the water by combining them into heavier particles that settle out. The most widely used coagulants are aluminum-based such as alum and poly aluminum chloride.

Sometimes a slight pH adjustment will help coagulate the particles, as well.

Flocculation

When coagulation is complete, the water enters a flocculation chamber where the coagulated particles are slowly stirred together with long-chain polymers (charged molecules that grab all the colloidal and coagulated particles and pull them together), creating visible, settleable particles that resemble snowflakes.

Sedimentation

The gravity settler (or sedimentation part of the wastewater treatment process) is typically a large circular device where flocculated material and water flow into the chamber and circulate from the center out. In a very slow settling process, the water rises to the top and overflows at the perimeter of the clarifier, allowing the solids to settle down to the bottom of the clarifier into a sludge blanket. The solids are then raked to the center of the clarifier into a cylindrical tube where a slow mixing takes place and the sludge is pumped out of the bottom into a sludge-handling or dewatering operation.

The dewatering process takes all the water out of the sludge with filter or belt presses, yielding a solid cake. The sludge water is put onto the press and runs between two belts that squeeze the water out, and the sludge is then put into a big hopper that goes to either a landfill or a place that reuses the sludge. The water from this process is typically reused and added to the front end of the clarifier.

Filtration

The next step is generally running the water overflow into gravity sand filters. These filters are big areas where they put two to four feet of sand, which is a finely crushed silica sand with jagged edges. The sand is typically installed in the filter at a depth of two to four feet, where it packs tightly. The feed water is then passed through, trapping the particles.

On smaller industrial systems, you might go with a packed-bed pressure multimedia filter versus gravity sand filtration. Sometimes, depending on the water source and whether or not it has a lot of iron, you can also use a green sand filter instead of the sand filter, but for most part, the polishing step for conventional wastewater treatment is sand filtration.

Ultrafiltration (UF) can also be used after the clarifiers instead of the gravity sand filter, or it can replace entire clarification process altogether. Membranes have become the newest technology for treatment, pumping water directly from the wastewater source through the UF (post-chlorination) and eliminating the entire clarifier/filtration train.

Disinfection

After the water flows through the gravity sand filter, the next step is typically disinfection or chlorination to kill the bacteria in the water.

Sometimes this step is done upstream before filtration so the filters are disinfected and kept clean. If your system utilizes this step prior to filtration, you will need to use more disinfectant . . . this way the filters are disinfected and kept free from bacteria (as well as the filtered water). When you add the chlorine up front you're killing the bacteria and have less fouling. If bacteria sits in the bed, you might grow slime and have to backwash the filters more often. So it all depends upon how your system operates whether your system is set up to chlorinate upstream (prior to filtration) or downstream (after filtration).

Distribution

If the wastewater is being reused in an industrial process, it's typically pumped into a holding tank where it can be used based on the demands of the facility. If for municipal use, the treated water is usually pumped into a distribution system of water towers and various collection and distribution devices in a loop throughout the city.