

Municipal Water Treatment Processes

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CONVENTIONAL SURFACE WATER TREATMENT

Conventional surface water treatment plants are still being used throughout the United States. They typically consist of several steps in the treatment process. These include: (1) Collection ; (2) Screening and Straining ; (3) Chemical Addition ; (4) Coagulation and Flocculation ; (5) Sedimentation and Clarification ; (6) Filtration ; (7) Disinfection ; (8) Storage ; (9) and finally Distribution.

Let's examine these steps in more detail.

Collection – The source water for a municipal surface water treatment plant is typically a local river, lake, or reservoir. There must be a method to get this water to the water treatment plant. Quite often, a series of pumps and pipelines transport the water to the treatment plant. Sometimes, as is the case of San Angelo, water from a reservoir such as Twin Buttes can be transported to the water treatment plant via a river. Twin Buttes Reservoir is one of the water sources for San Angelo. The water is released into Lake Nasworthy where it is transported down the Concho River to the water treatment plant. At the water plant, large pumps are used to transfer the water up to the treatment facility. Treatment facilities are often engineered to utilize gravity water flow as much as possible to reduce pumping costs.

Many water treatment plants utilize water from more than one source. Blending groundwater with surface water is a method often used to improve the quality of the final product.

Screening and Straining – If you think about surface water sources, i.e., lakes, rivers, and reservoirs, you realize they contain varying amounts of suspended and dissolved materials. This material may include turbidity, color, taste, odor, microorganisms, fish, plants, trees, trash, etc. The material may be organic or inorganic, suspended or dissolved, inert or biologically active, and vary in size from colloidal to a tree trunk. Some of these larger items can impede equipment in the treatment process, such as a tree limb getting stuck in a water pump impeller. So the first process in conventional water treatment is to screen or strain out the larger items. This is often accomplished using a large metal screen, often called a bar-screen, which is placed in front of the water source intake. Large items are trapped on the screen as the water passes through it. These screens must routinely be raked or cleaned off.

Chemical Addition – Once the pre-screened source water is received into the treatment plant, chemicals are added to help make the suspended particles that are floating in the water clump together to form a heavier and larger gelatinous particle, often called floc. In this process, a chemical is added that reacts with the natural alkalinity in solution to form an insoluble precipitate. There are many different chemicals on the market that are used in this process. These chemicals are called *coagulants*. One of the most common that has been used for many years is aluminum sulfate, or alum. Some other very

popular coagulants are ferrous sulfate, ferric chloride, sodium aluminate, activated silica, and compounds called polymers that are manufactured chemicals made up of repeated small units of low molecular weight combined into molecules with very large molecular weights. These polymers are classified as cationic polymers (positively charged), anionic polymers (negatively charged), and nonionic polymers (neutrally charged). Regardless of which coagulant or combination of coagulants is used, they must be mixed very well with the water before they can form a heavier floc.

Coagulation and Flocculation - A rapid mix unit is usually used where the coagulant is added to the water to provide a very quick and thorough mixing. The water mixing is then slowed to allow the water to come in contact with the forming floc and allow it to increase in size. The continued mixing must be gentle to allow the floc to grow and gain weight, but fast enough to keep it in suspension until you are ready for it to settle in the clarifiers. The process of adding a chemical to cause the suspended material to “clump” into larger particles is called flocculation or coagulation. The treatment unit where coagulation and flocculation is performed is called the “flocculator”.

Sedimentation and Clarification – Once the flocculation process is complete, the water then passes over the weir in the flocculator and travels to the center of the clarifier, or sedimentation basin. Here, the water makes its way from the center of the clarifier to the saw tooth weir at the perimeter of the unit. As the water makes its way towards the weir, the large floc particles are allowed to settle out to the bottom of the clarifier. A rake continuously travels across the bottom of the clarifier and scrapes the settled floc to the center of the unit. Pumps are used to pull the settled “sludge” out of the clarifier and send it to a sedimentation / disposal pond. The water that passes over the weir is collected and transferred to the filters. The reason clarification occurs before filtration is so the majority of suspended material can be removed prior to filtration, which avoids overloading the filters and thus allowing much more water to be filtered before the filters must be backwashed.

Filtration – Clarified water enters the filters from the top. Gravity pulls the water down through the filters where it is collected in a drain system at the bottom of the unit. There are many different types of materials (media) used in filters. The most common being sand and gravel. Many conventional plants are now using granular activated carbon as the media of choice because it not only provides excellent mechanical filtration of particulate matter, but also removes organic compounds which can cause taste and odor problems.

Disinfection – Once the water has gone through the filtration process, it is about as clear and clean as it can get. However, there may still be bacteria and viruses remaining. To ensure these are destroyed, there must be a disinfection process employed. The most common disinfection process used in the United States is chlorination. Chlorine comes in many different forms including chlorine gas (most common), chlorine dioxide, hypochlorite (bleach), and others. Whichever method is used, chlorine is added to the water in an amount to ensure all microorganisms are destroyed. Water plants monitor the chlorine levels continuously and very carefully in the treated water. They must add enough chlorine to

ensure thorough disinfection of the water, but avoid adding excesses that can cause taste and odor problems when delivered to the consumer.

Storage – Once the disinfection process is complete, the water is stored. Storage usually takes place in an underground storage tank called a “clear well”, and also in elevated storage tanks that are visible around town. There must always be an ample supply of water available in the event of emergencies. These can include power outages, fires, floods, etc.

Distribution – So how does the water come out of your kitchen tap? The stored water is pushed through underground pipelines all over town in what is called a “distribution system”. The distribution system consists of large water pumps at the treatment plant, overhead water storage tanks, large pipelines, smaller pipelines, fire hydrants, valves, and water meters in your front yard.

Note: All of the treatment processes listed above are not necessary used at the San Angelo Water Treatment Plant. This document is meant to give a general description of processes typically used in the treatment of municipal water.

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