

SWIFT Pilot Project

The advanced water treatment process



Water purified by the Advanced Water Treatment Process at the SWIFT Pilot



The SWIFT Pilot housed in York River Treatment Plant's denitrification filter building



Reverse Osmosis (RO) membranes at the SWIFT Pilot



The UV Advanced Oxidation Process (UVAOP) at the SWIFT Pilot

Pilot Project Purpose

The Sustainable Water Initiative for Tomorrow (SWIFT) proposes the addition of advanced water treatment processes to purify HRSD's already highly treated water to meet drinking water standards, creating a valuable resource that could be used to replenish eastern Virginia's diminishing groundwater supply. HRSD evaluated the efficiencies of two different, proven technologies in conjunction with its existing treatment operations at its York River Treatment Plant: **Membrane-Based Advanced Water Treatment** and **Carbon-Based Advanced Water Treatment**. Piloting these processes demonstrated SWIFT scientists' ability to create purified water and provided valuable insight used to design the **SWIFT Research Center** under construction in Suffolk, Va.

Membrane-Based Advanced Water Treatment

HRSD's highly treated water was first sent through an **ultrafiltration (UF) membrane** to remove particles as well as nearly all bacteria and pathogens. It was then forced through a semi-permeable **Reverse Osmosis (RO) membrane** using pressure, which allowed water molecules to pass through but excluded most dissolved salts, viruses and chemical contaminants. A UF membrane has a pore size of approximately 0.04 microns, while an RO filter has a pore size of approximately 0.001 microns- 5 million times smaller than a pinhole!

The concentrated contaminants flowed away from the RO membrane and formed a **Reject Stream** (or brine), which was treated separately at HRSD's York River Treatment Plant. Finally, the clean **Permeate Water** traveled through an **Ultraviolet Advanced Oxidation Process (UVAOP)** to remove any remaining bacteria, viruses and chemical and organic contamination- forming the **Finished Water**. These processes also removed most pharmaceuticals and contamination from personal care products. At the SWIFT Pilot, more than 80 percent of the water that was sent through the Membrane-Based Advanced Water Treatment System became purified water.

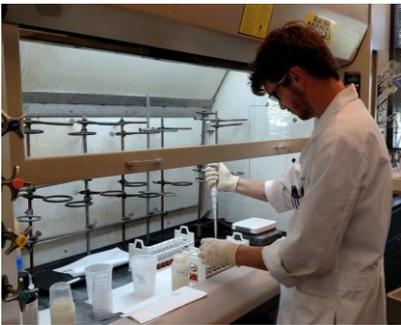


BAC GAC treatment train at the SWIFT pilot

Carbon-Based Advanced Water Treatment

First, **coagulant** and **polymer** was added to HRSD's highly treated water, which caused large particles to form and sink to the bottom. These large particles were removed and the water was then treated with ozone to break down organic material. Ozone is a strong oxidant, which means it can change **Total Organic Carbon (TOC)** into **Biodegradable Dissolved Organic Carbon (BDOC)**.

The broken-down organic matter (BDOC) was consumed by a film of microorganisms living on **Biologically-Active Granular Activated Carbon (BAC)** located in one chamber, while metal and chemical contaminants were adsorbed by **Granular Activated Carbon (GAC)** located in a second chamber. These processes also eliminated most pharmaceuticals and contamination from personal care products. Lastly, an ultraviolet (UV) disinfection system destroyed any remaining bacteria and viruses. At the SWIFT Pilot, almost 100 percent of the water that's sent through the Carbon-Based Advanced Water Treatment system becomes purified water.



HRSD chemist monitors the advanced water treatment process

Process control & proven technologies

How did we know **Membrane-Based Advanced Water Treatment** and **Carbon-Based Advanced Water Treatment** were working? The purified water being produced at the SWIFT Pilot was continuously monitored at multiple treatment points throughout the systems to ensure contaminants were being removed. This monitoring verified that all processes were performing correctly and that the final product was safe.

These are not new technologies. They have been successfully used to treat used water to federal drinking water standards for years in areas like Northern Virginia and California. Fairfax Water in partnership with the Upper Occoquan Service Authority have been using Carbon-Based Advanced Water Treatment to treat used water to federal drinking water standards since 1978. The Groundwater Replenishment System (GWRS) in Orange County, California has been treating the used water cleaned at the Orange County Sanitation District with Membrane-Based Advanced Water Treatment technology since 1977. It stores this renewable supply of drinking water in a groundwater basin.



Marsh near HRSD's York River Treatment Plant in Yorktown, Virginia

Next Steps

After evaluating both technologies, scientists and engineers at the SWIFT Pilot determined **Carbon-Based Advanced Water Treatment** to work most efficiently in conjunction with HRSD's existing treatment operations. This process is being incorporated into the **SWIFT Research Center** in Suffolk, Va. Researchers will continue to analyze new technological advancements in the water purification process to ensure SWIFT is including the safest, most effective treatment options available.