# City of Minneapolis

**Gina Sternberg,**
Chemical Engineering,
University of Minnesota, Duluth

## Organization Background

The City of Minneapolis Water Works was established in 1867, and began supplying drinking water to the City of Minneapolis in 1872. At present, they provide tap water to Minneapolis and several surrounding communities, producing and distributing an average of 57 million gallons of water per day.

*"While my goals for the project were laid out for me, and I got as much help as I asked for, the ultimate choices for how to achieve the goal were up to me. I planned experiments, chose data to analyze, and decided what that analysis meant and how I should move forward. This freedom helped me to build problem solving skills that will be invaluable to me moving forward with my career." ~ GS*

## Project Approach

The Columbia Heights Membrane plant receives softened water from the main Fridley plant and provides additional final filtration and treatment capacity to the system. The Columbia Heights plant uses ultrafiltration membranes for the final filtration step while the Fridley plant uses media filtration to remove fine particulates. Water is then treated with chlorine, fluoride, sodium hydroxide, and an ortho-polyphosphate corrosion inhibitor, and then it is ready for distribution. The membranes at the Columbia Heights plant are cleaned and disinfected frequently and the chemicals and water used for this task need to be neutralized before being discharged back to surface waters. The goal of this project was to reduce the use of chemicals for waste neutralization.

## Incentives To Change

The Columbia Heights Membrane Plant produces an average of 270,000 gallons per day of treated wastewater from membrane cleaning and disinfection operations. These processes consumes 170,000 lbs of sodium bisulfite (SBS) solution, 120,000 lbs of sodium hydroxide (NaOH) solution, and 80,000 lbs of bleach solution, costing $30,000 each year.

Neutralized waste is sent to a holding pond, and then into the Mississippi river. Salts form as a by-product of neutralization, so more efficient neutralization would lower salt concentrations and improve water quality of effluent into the river as well. The waste is currently within regulations, but Minneapolis Water is interested in preserving river health and improving waste water quality.

"For many years, we have suspected there were opportunities for more efficient use of chemicals in our neutralization process. We needed someone with strong capabilities in chemical process control to collect the data and evaluate the dynamic system. Having Gina work on site and with our plant operators and working at both the bench scale and with the full scale process provided the data and recommendations we needed."

*~ Annika Bankston, Superintendent of Water Treatment Plant Operations & Maintenance, City of Minneapolis Water*

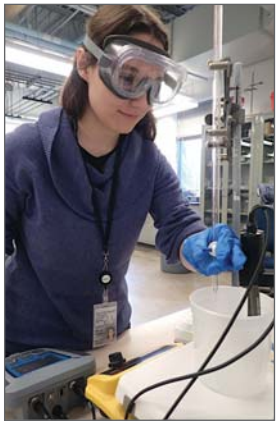
# Solutions

## Implement Self-Neutralization

The major recommendation of this project is the implementation of self-neutralization, which entails combining two different types of waste to partially treat each other before raw neutralization chemicals are added. Self-neutralization will save an estimated 34,000 lbs of SBS, 26,000 lbs of NaOH, and 80,000 lbs of bleach a year, resulting in a savings cost of $12,000. Programming for the automated self-neutralization is projected to cost $2,200. The time required for self-neutralization is essentially the same as for treating the two batches separately.

## Recallibration of Pumps

A second recommendation is to recalibrate pumps that deliver the neutralization chemicals to the tanks. The pumps for the same chemical do not deliver the same rate of addition, which is a source of variation between the neutralization of different batches. Recalibration would prevent excess chemical additions by pumps running faster than intended. Saving are likely small but so is the recalibration cost.



## Check Pipe Orifices

The third recommendation is to check pipe orifices in the neutralization tank, recirculation line, to ensure all the mixing ports are free of blockages. Again small savings and small cost.

## Introduce Pause Before Set Point Limit

Finally, adding a short pause to chemical additions shortly before reaching the set point limit shows promise, but work was not completed to fully characterize this change in procedure or to determine its impact.

| Recommendation | Annual Reduction | Annual Savings | Status |
|---|---|---|---|
| Self-neutralization | 34,000 lbs SBS<br>80,000 lbs Bleach<br>26,000 lbs NaOH | $12,000 | In Progress |
| Recalibrate pumps | 4,000 lbs NaOH | $300 | In Progress |
| Maintenance on tank mixing | 430 lbs SBS<br>300 lbs Bleach<br>290 lbs NaOH | $90 | In Progress |

**MnTAP Advisor:** Karl DeWahl, Senior Engineer