



# DRINKING WATER

## Residual Maintenance/TTHM Reduction

### CEDAR KNOX, NE SITE REPORT

**LOCATION**

Cedar Knox Rural Water Project, NE

**CONTACT:**

Gene Schroeder, Project Manager  
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**EQUIPMENT:**

MIOX-252, installed June 2000

**PREVIOUS DISINFECTION:**

Gas Chlorine

**CONCERNS:**

Cedar Knox wanted to improve safety at their facility and reduce TTHM formation.



**SOLUTION:**

The MIOX-252 system has eliminated hazardous chlorine gas and drastically improved the ability to hold a chlorine residual, while reducing TTHMs.

	<i>Gas Chlorine (before)</i>	<i>MIOX (after)</i>
<b>Safety:</b>	<ul style="list-style-type: none"> <li>Long transport of chlorine gas from warehouse to treatment plant.</li> </ul>	<ul style="list-style-type: none"> <li>Operators now transport only salt, eliminating handling of hazardous materials and associated safety regulations.</li> </ul>
<b>Residual Maintenance:</b>	<ul style="list-style-type: none"> <li>Dose of 3 mg/L was unable to hold a residual in farthest reaches of distribution.</li> </ul>	<ul style="list-style-type: none"> <li>Total dose reduced 30% to 2 mg/L with a consistent residual maintained at 0.6 mg/L, even after 6-7 weeks in distribution.</li> </ul>
<b>Pretreatment:</b>	<ul style="list-style-type: none"> <li>Use of KMnO4 has some effectiveness.</li> </ul>	<ul style="list-style-type: none"> <li>Jar testing has shown good results.</li> </ul>
<b>DBPs:</b>	<ul style="list-style-type: none"> <li>TTHMs were exceeding the limits with excursions above 100 ppb.</li> </ul>	<ul style="list-style-type: none"> <li>TTHMs are below 80 ppb.</li> </ul>
<b>System Maintenance:</b>	<ul style="list-style-type: none"> <li>Chlorine gas was easy to maintain.</li> </ul>	<ul style="list-style-type: none"> <li>After some initial issues, the MIOX system has run smoothly, requiring little to no acid-washing of the cells.</li> </ul>

## BACKGROUND:

The Cedar Knox Rural Water Project serves four communities and 696 hookups with a total of approximately 3,200 people in Northeast Nebraska. Their drinking water supply comes from the Lewis and Clark Lake, fed by the Missouri and Niobrara Rivers. Average flow is around 300,000 gallons per day (GPD) with flows peaking in the summer at 700,000 GPD.

Cedar Knox traditionally treated their water with 150-pound chlorine gas cylinders. The desire to improve safety and eliminate all hazardous chemicals led them to install their MIOX-252 on-site mixed-oxidant generator in 2000, with a total capacity of 50 pounds per day in winter of free available chlorine (FAC).

The disinfectant is injected prior to the clearwell and has about 8 hours of detention time before going out to distribution. The distribution system covers 360 miles of pipeline with the longest reach being 43 miles from the treatment plant.

## RESULTS:

- **Safety** – Operators previously had to transport 150-pound chlorine gas cylinders from the office-warehouse building 45 miles to the treatment plant via pick-up truck. The last 8½ miles were over graveled country roads that could be difficult to travel, especially in inclement weather. In contrast, employees now have to transport only salt and no longer have to deal with hazardous chemicals at the plant.
- **Residual Maintenance** – Cedar Knox has a long distribution system with a maximum reach of 43 miles. The water frequently has a 6-7 week detention time in winter with an additional 3-4 weeks of detention in the distribution system of the neighboring Village of Obert. When dosing gas chlorine at 3 mg/L, there was frequently no residual at the longest holding points. In contrast, mixed oxidants are dosed 30% less at only 2 mg/L and are *still* able to hold around 0.6 mg/L residual, even after 6-7 weeks! The residual lasts throughout Obert's system as well with no boosting required.
- **Pretreatment** – Cedar Knox experimented with use of mixed oxidants in pretreatment and experienced improved filter runs and microflocculation. However, due to taste and odor issues, Cedar Knox will now be adding carbon and must discontinue pretreatment with mixed oxidants to prevent the oxidant from being consumed by the carbon in the current treatment

*"The system has helped us a lot. There's no doubt in my mind if it were not for MIOX, we would not be able to hold the residual we do."  
– Gene Schroeder, Proj. Mgr.*

scheme. The water plant continues to investigate pretreatment options via jar testing.

- **DBPs** – After running the MIOX pilot system for 1 month, total trihalomethanes (TTHMs) were the lowest measured since 1986. A

temporary conversion back to chlorine resulted in an immediate increase in TTHMs. Since permanent installation, TTHMs have dropped from excursions over 100 ppb to less than 80 ppb, and levels at

the Village of Obert have improved as well. TTHM levels will be further reduced by introduction of carbon treatment prior to the filters. During the initial MIOX pilot run, the treated water was also tested for bromate and chlorite, both of which were non-detectable.

- **System Maintenance** – Cedar Knox was pleased with MIOX Corporation's support, commenting "The service has been good." Maintenance is slightly more than required with chlorine gas but has improved with new electrolytic cells. Acid-washing of the cells has been virtually eliminated and they have not seen any problems for quite some time. Use of Iron Out also drastically improved the life of the brine filters on their MIOX system. Gene Schroeder stated, "I'm sold on the system."