

From **Lower DOC** to **Lower DBPs**

By Miguel Arias

The town of Hudson Bay, with a population of 1,500 people, is located in the Red Deer Valley, between the Porcupine and Pasquia Hills in northeast Saskatchewan, Canada. It is widely known for its forestry, agriculture and wildlife.

Like many rural communities in the province, Hudson Bay is faced with treating a challenging potable water source. Its raw water is high in dissolved organic carbon (DOC), which can vary by 4 mg/L throughout the year. DOC is a known precursor to the formation of halogenated organic disinfection byproducts (DBPs) such as trihalomethanes.

Due to the size of the population, staffing at the water treatment plant is limited to two full-time operators plus manual help, if required. Staff size dictates that water treatment unit processes must run efficiently due to an upper boundary on time that can be dedicated to successful operation. Prior to the installation of the Magnetic Ion Exchange (MIEX) pretreatment process, the main unit operation was a coagulation and filtration skid with permanganate dosed in the raw water and chlorination after filtration.

DOC Removal

The raw water source for the treatment plant is a reservoir fed by the Fir River. Historically, the influent river raw water quality varies dramatically on a seasonal basis; therefore, it is difficult to optimize chemical dosing to match changing raw water conditions.

Operating a MIEX pretreatment system prior to the existing water treatment plant allows for a muted influent DOC response to increasing raw water DOC. The raw water DOC varied from 7.7 mg/L to 11.8 mg/L, with a standard deviation of 1.4 mg/L over the course of 2012.

With the pretreatment system continuously operating, the effluent DOC averaged 2.8 mg/L with a standard deviation of 0.5 mg/L, for an

Pretreatment system helps small town reduce DBP formation & chemical use



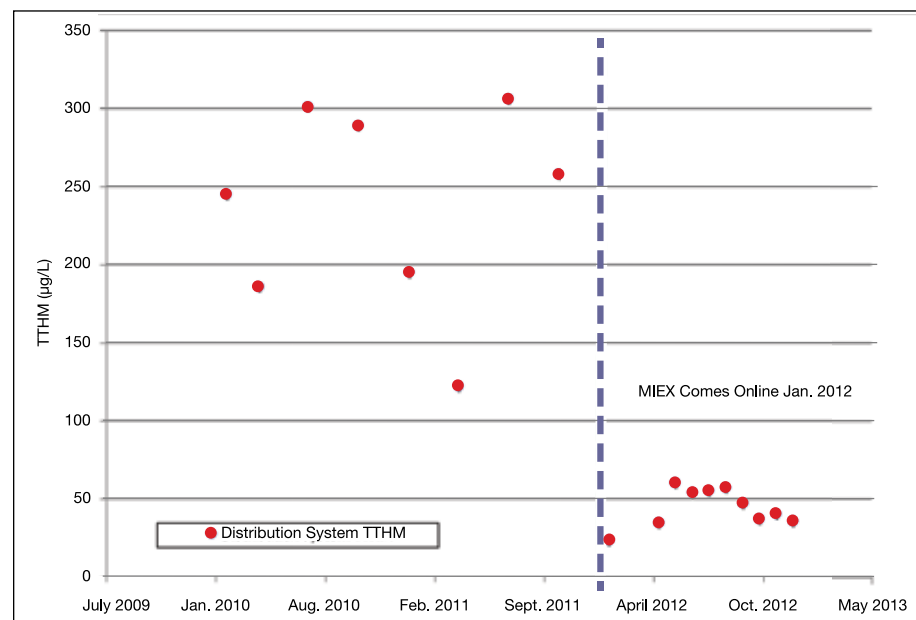
The new pretreatment system helps Hudson Bay meet regulatory requirements for DBPs.

average removal of 69% compared with the raw water. The decrease in standard deviation from 1.4 to 0.5 mg/L limits the variability of the raw water quality, simplifying downstream rapid mix-coagulation-flocculation treatment processes.

Prior to installation of the pretreatment system, an increase in DOC would require plant staff to rapidly

optimize coagulant and chlorination doses to enhance DOC removal and maintain disinfection residuals. Since the installation of the system, the excess capacity on the MIEX resin has allowed for simpler plant operation because a large percentage of DOC has been removed prior to coagulation, and spikes in DOC have been attenuated. Therefore, coagulation can

Figure 1. TTHM Levels Before & After Installation



be optimized on turbidity removal, a measurement instantaneously available by analyzing floc settling characteristics and effluent turbidities.

Additional Benefits

DOC in potable water sources can react with chlorine to form DBPs. The total trihalomethane (TTHM) regulatory limit is 100 µg/L in Canada and 80 µg/L in the U.S.

The town of Hudson Bay had consistently exceeded regulatory limits for TTHM formation prior to the commissioning of the new pretreatment system in January 2012. TTHM concentrations averaged 238 µg/L for 2010 and 2011. Since the new system came online, TTHM measurements have averaged 44 µg/L. The maximum distribution system TTHM measured 60 µg/L during 2012 operations, below both Canadian and U.S. Environmental Protection Agency standards.

Chemical savings also are a direct effect of reducing the DOC at the plant headworks, where downstream reductions in chlorine and coagulant doses are realized.

The average pre-installation coagulant and chlorine doses in 2010 and 2011 were 31 mg/L and 5.3 mg/L, respectively. These doses were reduced after system commissioning by 41% for coagulant and 63% for chlorine, to yield average doses of 18 mg/L for the former and 2 mg/L for the latter, analyzing 2012 in its entirety.

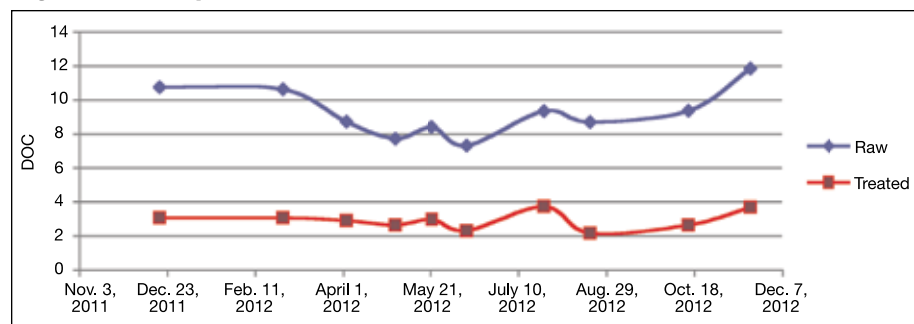
The installation of the MIEX pretreatment system in Hudson Bay has yielded several benefits, all stemming from DOC removal at the plant headworks. The influent raw water quality has become increasingly predictable for a river-influenced source; therefore, the need to make significant adjustments to chlorine and coagulant doses has decreased. The chemical use has both lowered and become more predictable, allowing for decreased frequency of chemical deliveries and aiding plant staff in planning chemical storage.

Ultimately, of all the benefits that were realized, the most important is the quality of the water delivered to customers. Water that is below regulatory limits for DBPs and that tastes good (because of low DOC) allows the citizens of the small community to reap benefits normally reserved for larger treatment facilities. Currently, the MIEX pretreatment system is operating in plants delivering 25 gal per minute to plants as large as 30 million gal per day. *wqp*

Miguel Arias, Ph.D., P.E., is project manager/water treatment specialist for Orica Watercare. Arias can be reached at miguel.arias@orica.com or 303.268.5074.

For more information on this subject write in 1005 on this issue's reader service card.

Figure 2. Comparison of DOC Levels



REGAL™ GAS CHLORINATORS GREEN MACHINE

REGAL leads the industry in green technology. The REGAL Gas Chlorinator lowers energy costs and chemical costs by using 100% chlorine which is a natural element.



SAFE, RELIABLE, EFFICIENT AND ECONOMICAL

- ALL-VACUUM DESIGN • EASY TO MAINTAIN & CLEAN
- ENGINEERED FOR LESS DOWNTIME & CORROSION RESISTANCE
- FEWEST PARTS • FAST DELIVERY • MADE IN THE USA

For Gas Chlorine, Choose Regal's GREEN Machine!
For more info, call Jill at 1-800-327-9761

@chlorinators incorporated

1044 SE Dixie Cutoff Road, Stuart, FL 34994 USA • Tel: 772-288-4854
Fax: 772-287-3238 • www.regalchlorinators.com • Email: regal@regalchlorinators.com

MADE IN THE USA



RED, WHITE, BLUE and GREEN too!

The REGAL™ Gas Chlorinator is made with pride in the USA and sets the standard for safety, reliability and economy.

REGAL also leads the industry in green technology: lowering energy costs and chemical costs by using 100% chlorine which is a natural element.

- ★ ALL-VACUUM DESIGN ★ EASY TO MAINTAIN & CLEAN
- ★ ENGINEERED FOR LESS DOWNTIME & CORROSION RESISTANCE
- ★ FEWEST PARTS ★ FAST DELIVERY

For more info, call Jill at 1-800-327-9761

@chlorinators incorporated

1044 SE Dixie Cutoff Road, Stuart, FL 34994 USA • Tel: 772-288-4854
Fax: 772-287-3238 • www.regalchlorinators.com • Email: regal@regalchlorinators.com

Write in 771

Iron or H₂S problems? Charger has your natural solution.

CHARGER
Water Treatment Products
www.chargerwater.com

The Charger IronBreaker^{III} Iron and H₂S filter system uses natural oxidation!

- No Chemicals • No Air-Pumps • No External Venturis •

Simply...Clean. Clear. Water.

For more information about the IronBreaker^{III},
call your local Charger warehouse.



U.S. Patent No.
5,919,373



IronBreaker^{III}
by Charger

Products • Training • Service • Expertise

- Illinois: 800-642-4274 • Pennsylvania: 800-327-5572 •
- Florida (East): 866-917-7638 • Florida (West): 800-936-7940 •
- Fort Worth, Texas: 877-627-9976 • San Antonio, Texas: 877-553-3010 •
- Bedford, NH: 866-201-7853 • Nevada: 888-210-8810 •

Write in 772