

Safe Water for All

Ending the Drinking Water Crisis in First Nations Communities

STURGEON LAKE
CREE NATION



About Sturgeon Lake

Sturgeon Lake Cree Nation (SLCN) is located in Saskatchewan, approximately 50 kilometers from Prince Albert. It has 2,273 registered members, of which 1,200 live on-reserve. The Sturgeon Lake Indian Reserve No. 101 houses important services, including the band office, school, fire hall, a community health clinic, and a healing lodge. In 2017, the community constructed a new youth centre that provides mental health services to the community, and helps researchers identify ways to improve their approach to this important issue.

Similar to many First Nations across Canada, the Sturgeon Lake community suffered from chronic water quality issues. Conventional treatment technologies had failed to adequately clean the water, especially after lake turnovers. Community members often relied on bottled water for consumption. In 2016, the SLCN implemented Sapphire Water's Integrated Biological and Reverse Osmosis Membrane (SIBROM) technology, and were finally able to provide residents with clean, safe, and fresh drinking water using a modern, cost-effective technology.

Water quality challenges in First Nation communities

Even in 2018, unsafe water continues to plague many First Nations and remote communities across Canada. According to Indigenous Services Canada, as of July 2018, more than 4,000 homes and nearly 300 community buildings on reserves were affected by 73 ongoing long-term water advisories.

Budget Sufficiency for First Nations Water and Wastewater Infrastructure, a 2017 report by the parliamentary budget office, shows that more than \$3 billion in upfront spending is needed by 2020 to bring water and wastewater services in First Nations communities to the same standard as the rest of Canada; another \$360 million is needed on an annual basis for ongoing operations and maintenance. The same report determined that nearly 40% of the First Nations drinking water systems were categorized as high risk and an additional 34% were considered medium risk.

The federal government has committed to eliminating boil-water advisories in First Nations by 2021. However, meeting this deadline requires not only significant financial investments, but a fundamental upgrade to the approach and technologies used to treat the water.

Most remote First Nations face several critical challenges in bringing safe, drinkable water to their communities: poor quality source water, ineffective treatment technology, and high costs. The isolated location of these communities also compounds the problem. In its 2011 National Assessment of First Nations Water and Wastewater Systems, the Department of Indigenous and Northern Affairs (INAC) found that the overall risk of a water system increases with remoteness.

**"It's like spring water now,"
said Dallas, about the
SIBROM treated water.**

Poor quality source water

Often, water quality issues in remote and rural communities can be traced back to the source of the water, whether ground or surface. Those in Canada's prairies are especially vulnerable, with source water naturally contaminated with toxic elements including arsenic, high levels of sulphate and ammonium nitrate, iron, manganese, and organic matter. Surface water, which Sturgeon Lake relies on, is also exposed to other pollutants, such as factory waste and landfill leachate.

Ineffective technology

Conventional treatment technologies generally disregard the unique composition of source water found in many remote and First Nations communities. INAC's 2011 study found that of the 192 First Nations water systems flagged as high risk, 150 were classified as such based on system design and/or operation. Ultimately, conventional technology and approaches fail to deliver clean and safe water to many smaller, remote communities.

High costs

The remote location of most rural and First Nations communities often dramatically increases the cost of building and maintaining conventional water treatment systems. The extreme climate found in many such communities also places tremendous seasonal stress on components, leading to expensive repairs and logistical costs. In addition, given their remote locations, communities generally rely on one single source of water with no alternative supply in close proximity. Connecting to another water supply requires extensive investment in water distribution networks.

Water quality in Sturgeon Lake

Sturgeon Lake Cree Nation relies on three wells for its source water, which are connected to Sturgeon Lake. Each fall, the Lake experiences turnover, when the cool water on the surface becomes dense, sinks to the bottom, and forces warmer water beneath to rise to the surface. This changes the composition of the raw water, and presented a substantial treatment challenge to the previous facility, which was not able to deliver drinkable water. "Turnover was the worst time. Filters would keep shutting down, over and over again," said Dallas Moosehunter, the plant operator at the new SIBROM facility in SLFN. "The algae would get really bad. The water would irritate skin, and lead to rashes."

Prior to Sapphire Water, SLCN's water had failed to meet health and aesthetic quality guidelines. The current treatment process, conventional clarification, had not been effectively or consistently removing impurities from the raw water. The permeate water still contained contaminants at levels above regulatory standards and objectives, including conductivity, sums of ions, hardness, TDS, turbidity, sulfate, iron, manganese, and arsenic. INAC's assessment placed Sturgeon Lake's water supply and treatment design in the high-risk category on several key measurements, including source risk, design risk, and operations risk.

Concerns about the aesthetic quality of the water, especially the colour and odour, meant that even when the treated water met minimum guidelines, residents were cautious in consuming the water and simply did not trust it. Despite the heavy use of odour control chemicals, most of the residents resorted to bottled water.

"The bacteriological tests were fine, but the people just didn't buy it," said Dallas. "They weren't comfortable with drinking unclear water, even if the numbers were fine."

Conventional water treatment technologies had failed to provide the Sturgeon Lake First Nation community with clear, drinkable water. Located near Prince Albert, Saskatchewan, community leaders upgraded to Sapphire Water's IBROM technology in 2016, finally delivering water residents could trust.



The Sapphire Solution

Sapphire Water's IBROM technology (SIBROM) was developed specifically to meet the needs of a remote First Nations community. It took two years of extensive research and testing to build an effective system - a stark contrast to conventional technologies that disregard the unique challenges of rural and remote communities and fail to adequately treat source water. Sturgeon Lake implemented the SIBROM in 2016, and the improvements have been dramatic. "It was a complete 180. It's like spring water now," said Dallas.

Destroying contaminants, not just isolating them

Rather than relying heavily on chemicals, the SIBROM uses biological filtration through a clay media called Filtralite® that attracts bacteria found in the source water. This bacteria either fully consumes or transforms the contaminants into other compounds which are more easily removed by membrane treatment. This step effectively destroys and neutralizes contaminants such as hydrogen sulfide, iron, arsenic, ammonia, and dissolved organic matter.

In the second step of the treatment process, a reverse osmosis (RO) membrane is used to eliminate residual contaminants. And lastly, the water is further treated by a pH adjustment process, stabilizing its pH levels and making it non-corrosive. No biological contaminants remain in the water supply.

Parameter	Raw Water Quality	SIBROM Treated Water Quality	Canadian Drinking Water Guidelines
D.O.C. (mg/l)	4.1	0.20	<1*
Iron (mg/l)	5.1	<0.0005	<0.3
TDS (mg/l)	1730	62	<500
Turbidity (NTU)	22	<0.2	<1

**No guideline. Health Canada has not established a drinking water quality guideline for dissolved organic carbon. Our target limit for these parameters is <1 mg/l. For further technical information, please contact: sas@sapphire-water.com*

Cost-effective technology

The SIBROM system dramatically reduces the amount of chemicals used during the treatment process - decreasing the direct cost of materials, and the associated freight and logistics costs which can quickly escalate. SIBROMs require only antiscalant and chlorine, at volume levels up to 90% less than conventional technologies.

Remote monitoring

Sapphire's modern, digital interface, requires less operator intervention and manual inputs. At Sturgeon Lake, Dallas relies on an app on his phone to remotely monitor the status of the treatment facility and key indicators. "I don't have to be sitting in the treatment plant all day. Before Sapphire, you couldn't leave the plant and had to check performance every two hours," he said. The app allows him remote access to the treatment facility's computer system through his phone. "One person can manage the system quite well. Before, you needed at least three," Dallas continued, citing significantly lower labour costs.

"I get many comments from the community members and often get congratulated on the job I'm doing. I've quit buying bottled water," said Dallas. "People now trust the water."

About Sapphire Water

Sapphire Water International is a Canadian company specializing in the design and implementation of long-term, leading-edge water and wastewater treatment systems for small and remote communities of up to 1,000 in population. Through its SIBROM technology, Sapphire Water delivers water to these communities that exceeds all international water quality guidelines. There are 20 full-scale SIBROM plants in operation and four under construction in Western Canada today.