

Due Diligence and Biological Water Treatment Methods



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Edmonton, Alberta

Due Diligence

To honour all those who have suffered health problems from unsafe drinking water, we must practice due diligence for our future generations.

What we do today is prudent for tomorrow's resources



The Crown

- The Dominion of Canada
- Federal Government – INAC
- Provincial Government

Treaty Rights = Water Rights

First Nations will not relinquish or diminish our treaty rights!

Due Diligence What Is It?

- Everyone responsible for the production of drinking water must carry out due diligence within one's responsibilities.
- If something is wrong with the water and you know about it you have to act within your responsibility.
- What is wrong may not even be in any guidelines.

Liability Vs. Responsibility

2007 Contribution Agreements

INAC quietly changed text in the 2007 Contribution Agreements to pass full responsibility for water quality on reserves to Chiefs and Council!

INAC was not practicing due diligence when they changed the contribution agreements, they were trying to avoid their liability and are failing to fulfill their fiduciary responsibility to provide First Nation people with safe drinking water!

But is it only INAC who are responsible for practicing due diligence for First Nation drinking water?

Failing Due Diligence

- Failing due diligence can be punishable by law.
- Therefore, it is important to have a clear understanding of responsibilities.

Band Council Resolution (BCR)

Be it therefore resolved that:

“Name” First Nation will not be held liable for the quality of our drinking water until such time that we can produce truly safe drinking water for our community. The quality of our drinking water needs to meet the full extent of the Canadian Drinking Water Quality Guidelines as well as disease-causing microbe regulations enshrined in regulations in the United States and Europe, which are expected to be adopted by Canada as well. Raw water and treated water testing needs to be carried out regularly to ensure that the implemented water treatment processes remain effective.

Due Diligence

- Heedfulness
- Earnest and mindful persistence

What can you do to practice due diligence?

Document, document, document!

Notify superiors, state in proposals, write to MLAs and MPs, write in trade/industry/professional publications, educate Canadians.



What is a Water Keeper to Do?

I, Tony Steinhauer, am the Water Keeper at Saddle Lake Cree Nation.

We had a “state of the art” ultrafiltration membrane system. We were using up to \$15,000 worth of chemicals per month. Yet, the water was not safe! Our community challenged Health Canada and called our own boil water advisory beginning in 2004.

When they Run a Centre for Disease Creation

We would have liked to be known as a Centre for Disease Prevention. Unfortunately, for years, I signed off my correspondence with “Centre for Disease Creation” as I felt we were unable to produce safe drinking water for our people even though the federal government and engineers had assured us the water was safe. Well, some of these people started agreeing with me...

That Chemical Attack Was Not Working!



Old Treatment Method, Sludge Going Back Into the Lake



Zenon System



Cleaning Skid and Backwash Tanks



01/28/2010

One of the Reasons for This? Our Water Supply was Deplorable!

“I’ve never seen a water supply in such poor shape! The lake is covered with blue greens, which make mats in nearshore areas. Yet this is a drinking water supply



for several thousand First Nations people! This is a story that city people need to hear and see. They cannot imagine that we have water problems of this magnitude in Alberta!” – Dr. David Schindler on Saddle Lake’s source water.

Why Wasn't Conventional Chemical Attack Working?

- 💧 Conventional treatment methods are not designed to effectively remove bacteria or viruses
- 💧 They rely on inactivation typically by chlorine
- 💧 Chlorine is ineffective when ammonium is present in source water



The Solution: Biological Water Treatment Methods

Biological water treatment methods use little to no chemicals and are much better for the environment!



Indigenous Laws and Biological Treatment

- Science can work with traditional Indigenous Laws by providing safe drinking water with minimal or no chemicals, in harmony with Aboriginal culture.



The Integrated Biological Reverse Osmosis Membrane (IBROM) Treatment System

What is the IBROM?

- 💧 A biological water treatment system (biologically based, as opposed to chemically based).
- 💧 Developed by Dr. Hans Peterson for the Yellow Quill First Nation community in Saskatchewan.



Biological Filtration

- 💧 Provide a “hotel” for bacteria
- 💧 Provide the right conditions
- 💧 A combination of biological and physico-chemical processes



Benefits of the IBROM

What benefits are derived from using the IBROM treatment system as opposed to the conventional “chemical attack” treatment methods?

- 💧 Significant reduction in the amount of chemicals used. It is estimated that there will be a 99% reduction in chemicals used in the treatment process which translates into a 99% reduction in the amount of chemicals returned to the environment.
- 💧 The quality of the water which is released back into the water cycle is actually higher in quality than that which is taken into the system for treatment.
- 💧 Effectively treating difficult to treat source water.

Another Benefit of the IBROM

Biological pre-treatment avoids biofouling of RO membranes



Integrated Biological and Reverse Osmosis Membrane Treatment (IBROM)

- 💧 Biological filtration can only remove compounds that are either a nutrient or an energy source to bacteria. The goal is to remove all such compounds so that no further bacterial growth can occur in the membranes or distribution system.
- 💧 Reverse Osmosis Membrane treatment will then remove most compounds without plugging (fouling).
- 💧 After membrane treatment, it is desirable to add calcium and magnesium back into the water.

Data from Saddle Lake Centre of Disease Prevention

Substance	Raw	Treated
Sodium (mg/L)	44.3	1.6
Arsenic (mg/L)	0.00209	<0.0005
Alkalinity (mg/L)	258	5.6
Total Organic Carbon	26.7	<1.0
Turbidity (NTU)	4.79	<0.10
Chloride (mg/L)	8.96	0.62
pH	8.88	7.55
Colour	14	<2

Biological Treatment Removes

- 💧 Iron
- 💧 Arsenic
- 💧 Ammonium
- 💧 Phosphorus
- 💧 Bioavailable DOC
- 💧 Turbidity
- 💧 Sulphide

Reverse Osmosis Membrane Treatment Removes

- 💧 Dissolved solids including Calcium, Magnesium, Manganese, Sulphates, and Nitrates giving a TDS of 17 mg/L
- 💧 Any remaining ammonium and arsenic ions
- 💧 Dissolved Organic Carbon
- 💧 Viruses, bacteria, and protozoan parasites

Membrane Treatment

- 💧 Must be used in conjunction with other treatment methods
- 💧 Membrane treatment can remove health and aesthetic components including microbes
- 💧 Biological pre-treatment ahead of the membranes can remove microbial nutrients providing better quality finished water and less operational problems including less fouling of the membranes

An Example of How the IBROM System Works

For example, traditional systems use potassium permanganate to remove ammonium ions. The IBROM system uses a nitrifying population of microbes to convert ammonium ions to nitrate. This eliminates the use of chemicals in the conversion of ammonium, which is necessary for its removal from the water.



Another Example of How the IBROM System Works

Another example involves water alkalinity. Other treatment processes use chemicals such as sodium hydroxide and calcium carbonate as neutralizing agents. In the IBROM system, the Reverse Osmosis (RO) membrane removes the alkalinity without the addition of chemicals.



Arsenic Contamination

- 💧 Drinking water that is not tested can result in chronic arsenic toxicity
- 💧 This exposure can result in cancer and a multitude of other ailments
- 💧 But, symptoms will take years before they appear



Arsenic lesions on hand

Arsenic Removal

Biological treatment will remove some arsenic and convert any As^{3+} to As^{5+}

As^{5+} is effectively removed from the water by RO membranes while As^{3+} is not

At George Gordon First Nation around 80 ug/L in raw water is decreased to <10 ug/L

Backwashing Uses 14,520,000 Less Litres of Water Per Week and Uses Waste Water Instead of Treated Drinking Water

Backwashing with the old water treatment system:
4 filters each 3x/day, 840,000 L of water per backwash =
17,640,000 L of TREATED drinking water used for
backwashing per week

Backwashing with the new IBROM water treatment system:
2 lead filters once per day, 2 filters following the lead filters
3x/week, last 2 filters at least 2x/week, 60,000 L of water
per backwash = 3,120,000 L of WASTE WATER from the RO
units (or raw water or water from the bio trains) per week

Less Backwashing

Think about how much time backwashing 139 fewer times per month (1664 fewer times per year) will save your community's water treatment plant operators!



Think about how much money this will save over the years!

Development of IBROM at Yellow Quill

Prior to 2001, Yellow Quill First Nation had been on a boil water advisory since 1995 because of poor source water and inefficient treatment equipment.



RO Treatment



Saddle Lake: First Surface Integrated Biological Reverse Osmosis Membrane Treatment System in the World



Biological Treatment System



Online Treatment System



IBROM Treatment Process



IBROM Treatment Process



IBROM Treatment Process



RO Membrane



RO Monitoring and Cleaning Unit



Nature's Way: Biological Filtration!



Biological Treatment: A Proven, Robust, Environmentally Friendly Method of Treating Water

Biological is not new, it has been proven repeatedly, this treatment uses only natural means to treat the water and leaves the water in a very stable state for ongoing treatment, a biological treatment plant is as chemical free as the current regulations will allow.



INAC Supports Research and Development

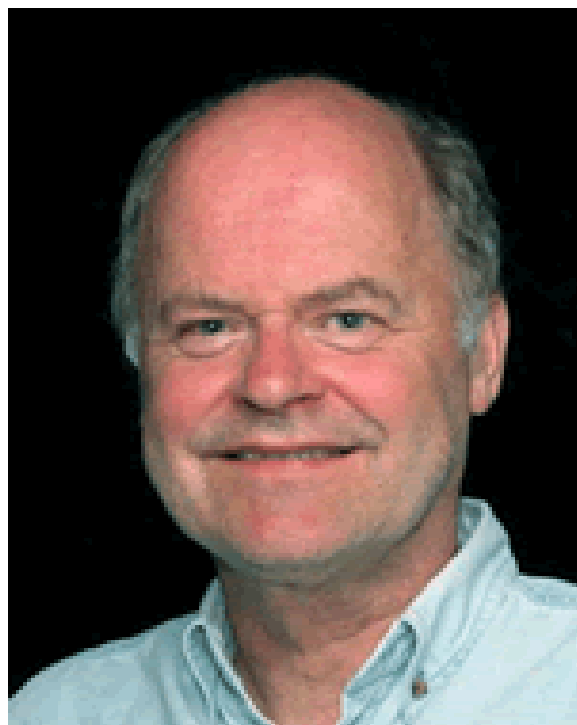
Yellow Quill, Pasqua,
George Gordon's,
Saddle Lake,
Whitecap Dakota
Sioux, Kawacatoose
and Stanley Mission
First Nations have
proceeded to use
SCIENCE to improve
drinking water and
wastewater quality.



A Proven Success

- 💧 Biological treatment can replace conventional treatment with little need for chemicals.
- 💧 Following the biological treatment, reverse osmosis treatment can make salt water drinkable.
- 💧 Distributed water is biologically stable (i.e., there is little opportunity for bacteria to grow in the distribution system and there is virtually no chlorine demand), chlorine levels at the treatment plant are similar to those at the distribution end.
- 💧 Life-cycle costs are much reduced.

Dr. Hans Peterson



- 💧 Founded SDWF
- 💧 Volunteer Executive Director of the SDWF 1999-2007
- 💧 Trained the AAWTT
- 💧 Invented the IBROM
- 💧 Has greatly improved the lives of many through his technological innovations, sound scientific knowledge, and drive to make the drinking water quality situation better for thousands of First Nation and rural citizens.

SDWF Mission

- **Encourage** the universality of safe drinking water by supporting innovative research and development.
- **Increase** awareness of health concerns from consumption of poor quality water.
- **Act** as a policy advocate to ensure appropriate action is taken to provide safe drinking water to all people.



*We find treatment and preventative solutions to make surface and ground water
safe for human consumption*



Please visit us at:

www.safewater.org

The AAWTT is supported by

