Northern Territories Water and Waste Association

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Innovative Water Treatment Technology In Tulita, NWT

by Vincent Tam, P. Eng, Department of Public Works and Services
Technical Services Section, Government of the NWT

Introduction

Tulita is a small community of about 400 people, located along the Great Bear River at its confluence with the Mackenzie River, at 64°54'N latitude and 125°34'W longitude. Tulita is 523 air km south-east of Inuvik and 624 km north-west of Yellowknife..

The primary source of drinking water is the Great Bear River. The present water supply and distribution system consists of the following major components :

1) Twin inclined shaft intake system complete with submersible pumps
2) Truckfill facility
3) Chemical system for disinfection

Due to high turbidity problems occurring during spring breakups and intake starvation at low water levels in the late fall, Reid, Crowther and Partners Ltd. was engaged in 1997 by GNWT to provide engineering services for the modification of the existing water supply system to provide safe, good quality drinking water to Tulita.

The scope of work in the original Terms of Reference included the following tasks : A storage reservoir at the existing site using the existing intake system with appropriate modifications; Upgrade existing truckfill and pumphouse facilities to meet current codes and requirements

The scope of work was later modified due to unfavourable geotechnical conditions at the existing site. The location for the intake was relocated to a deeper channel upstream of the existing location. A new truckfill pumphouse with treatment facility and short-term, above-ground storage tank was proposed at the new site. Below grade structures were not recommended given the thaw susceptible nature of the permafrost in the project area.

Treatment Options

Some of the objectives established for treatment process were :

- User friendly (simple to operate and easy to maintain)
- Meet "Guidelines for Canadian Drinking Water Quality" (GCDWQ)
- Cost effective
- Minimize the use of chemicals

One of the most important objectives for the community is to minimize the use of chemicals. Several treatment options such as conventional treatment, direct filtration and membrane technology were considered and evaluated.

Cost effectiveness has not been addressed because of lack of operational experience with the membrane system and significant differences in system design and requirements between the two systems.

A membrane process is typically much smaller and more compact in footprint than a conventional treatment system. The requirement for chemical feed systems also increases the spatial requirement of a conventional treatment plant.

Based on historical costs of conventional treatment systems of similar size in Ft. Resolution and Ft. Providence, the capital cost of a membrane system such as microfiltration is about 30% more expensive. However, this higher equipment capital cost may be offset easily by the lower capital cost and lower O & M costs for the building because of reduced spatial requirements.

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Consultants and Contractors

Comparison of Treatment Processes

	Conventional Treatment	Direct Filtration	Membrane Process
Chemicals used including chlorine	Typically 3 depending on raw water quality	same	Only chlorine
Microbial risks	Protozoa such as giardia and crytosporidium	same	Positive barrier
Risk of aluminum carry-over	If alum is used as primary coagulant	same	Nil
Meet GCDWQ	yes	yes	Yes and future guidelines for protozoa
System complexity (O & M)	Chemical feed systems, unit processes	simpler	Only one chemical feed system, regular maintenance check (automatic) Pretreatment may be required depending on the raw water quality
Optimization process (O & M)	Chemical feed systems and unit processes	simpler	Only one chemical feed system, regular maintenance check (automatic)

Evaluation of the Membrane Filtration Process

In North America, membrane separation processes have been used for many years in industrial and commercial use. It is only in recent years that membrane filtration processes have gained significant momentum in treating municipal water for public consumption. This change is largely due to the advancement in membrane technology, which improves the service life of membranes, increases the recovery rate and makes it more affordable.

Membrane filtration is a physical process that removes particulates larger than the pore size of the membrane openings. Membrane filtration can be classified into 4 categories: Microfiltration (MF), Ultrafiltration (UF), Nanofiltration (NF), and Reverse Osmosis (RO).

Membrane filtration usually requires pre-treatment, and the method of pre-treatment is normally a function of the quality of the source water and the treatment objectives.

The pre-treatment could be as simple as a cartridge filter to remove coarse particles, or it could be another treatment process to remove organic and inorganic contaminants such as iron, manganese, and natural organic matter that may have an negative impact on the service life of the membranes.

Comparison of Membrane Filtration Technologies

Process	Microfiltration MF	Ultrafiltration UF	Nanofiltration NF	Reverse Osmosis RO
Pore size (μm)	0.1	0.01	0.001	0.0001
Operating Pressure (psi)	10 - 100	10 - 150	150 - 300	200 ->1000

Of the four types of membrane processes, RO removes the smallest particulates and operates under the highest feed pressure. RO uses high feed pressure to overcome the osmotic pressure of the liquid to cause the pure water in the feed water to pass through the semi-permeable membrane. The concentrate,

which includes dissolved salts and other contaminants, is retained and eventually drains to waste. RO is used in applications such as desalination.

MF is effective in removing particles and microorganisms larger than 0.1µm, such as bacteria and protozoa. Ultrafiltration rejects particles larger than 0.01µm, such as viruses, protein and sugar molecules. Nanofiltration is effective in removing dissolved salts, colour and some organic substances with high molecular weight. RO membranes are designed to concentrate low molecular weight organic materials and salts, while allowing water and solvents to pass.

Based on initial water quality information, turbidity appeared to be the only concern; subsequently, the microfiltration process was selected for further treatability study.

The advantages and disadvantages of using microfiltration process (MF) rather than other options such as conventional or direct filtration for turbidity removal are as follows :

Advantages	**Disadvantages**
θ meet GCDWQ θ only chemical process is chlorination for microbial protection θ filtered water quality not affected by feed water turbidity θ removal of particulates and microbes < 0.2microns θ reduce chlorine demand θ reduce trihalomethane formation potential (THMFP)	θ life of membrane θ lower recovery rate ~ 95% θ slightly higher capital cost than conventional treatment

Treatability Study

The consultant was commissioned to carry out a treatability study and a sampling program to confirm the feasibility of using the membrane separation process to treat the water from Bear River.

Raw and filtered water samples were collected and analyzed. Filtered water samples were obtained by passing raw water through a 0.2µm filter to simulate the actual process. The results are tabulated on the page which follows

Interpretation of Results

Based on the analysis, Tulita water can be classified as moderately hard, moderately buffered and slightly alkaline. The water has a Langlier Saturation Index of –1.4 and is considered undersaturated with a tendency to dissolve calcium carbonate.

The filtered water also met the Maximum Acceptable Concentration for turbidity during the sampling period. Iron and manganese concentrations, which normally would be a concern in membrane fouling, are quite low in the filtered water in spite of the raw water quality. This suggested that the iron and manganese detected in the raw water are most likely complexed with turbidity-causing particles and are removable using proper filters.

Although the Total Organic Carbon remains the same in the filtered water, its low concentration should not pose a big concern with membrane fouling. The low values in trihalomethane formation potential (THMFP) suggested that disinfection by-products in specific THMs should not be a concern in the treated water.

Treatment Process

The MF system selected consists of 6 modules of hollow fibre membranes. The membrane is made of polypropylene with a 550µm OD and a 300µm ID. The nominal pore size is 0.2µm. The normal operating pressure is about 30psi.

The flow configuration is direct flow with feed water flowing in from top and bottom and filtrate exit either from the top or bottom of the module. The capacity of the system is rated at 25L per module.

The microfiltration system specified by the consultant include the major components which follow :

Tulita Water Quality Study Results

Parameter	Unit	Raw 1998 May 28	Filtered May 28	Raw Aug 13	Filtered Aug 13	Raw Nov 17	Filtered Nov 17	Raw 1999 Apr 23
pH		7.92		7.99		7.81		7.91
Conductivity	mS/cm	168		175		175		169
Colour	TCU	5	5	L5	L5	5		3
Alkalinity	mg/L	58.5		60		60.9		67
Carbonate	mg/L			L0.3		0.3		
Bicarbonate	mg/L	58.5		60		60.9		81
Calcium	mg/L	13.6		17.5		16.8	17.3	17.3
Magnesium	mg/L	6.95		6.97		7.39	7.48	7.7
Sodium	mg/L	4.54		4.47		4.89	4.97	5
Potassium	mg/L	0.753		0.78		0.79	0.82	<1
Chloride	mg/L	5.5		5.5		6.2	6.2	6.3
Sulphate	mg/L	15		17		16	16	16.9
Fluoride	**mg/L**			**0.11**		**0.13**	**0.11**	**0.16**
Tot. Hardness	mg/L	62.6		72.4		72.4	74	74.7
Turbidity	**NTU**	**9.7**	**0.5**	**28.5**	**0.4**	**5.7**		**2.17**
TDS	mg/L	95		103		109	112	94
TSS	mg/L	15	3		38	8	L3	
NO3-N+NO2-N	**mg/L**	**0.127**		**0.212**		**0.156**	**0.157**	**0.22**
Ammonia-N	mg/L	0.006		0.018				<0.05
Nitrite -N	mg/L					0.008	0.008	
Cation/anion-balance	%diff	1.9		0.19		10	62	
TOC	**mg/L**	**4**	**3.6**	**1.9**		**1.8**	**2.1**	**1.7**
DOC	**mg/L**	**3.3**	**3.4**	**1.7**		**1.8**	**2.1**	
Tot. Iron	mg/L	0.453	0.012	0.91	0.02	0.25	L0.02	0.06
Tot. Manganese	mg/L	0.007	0.0025	0.016	0.0037	0.0052	0.014	<0.003
TTHMs	**mg/L**		**0.005**		**0.024**	**0.005**		
TTHMFP	**mg/L**							**0.063**

Major System Requirements

Item	Procedures
Backwash	Initiate automatically either based on timer of when transmembrane pressure (TMP) reaches 15psi
Chemical clean	Initiate manually when TMP > 15psi
Pressure decay test (PDT)	Initiate manually, drain membrane and pressurize filter lumen to 15psi with air If pressure decay > 1.5psi per min, alarm will occur If pressure decay > 2psi per min, a shut down alarm will occur
Sonic test	Initiate manually when PDT fails, use stethoscope to isolate damaged module Damaged lumen may be repaired on site and reused

The service life of the membrane is somewhere between 5 to 10 years depending on the raw water quality and the operating conditions. The membrane can also be repaired on site depending on the magnitude of the damage. This will in effect extend the useful life of the membrane.

Recommendation

Based on the analysis, the microfiltration (MF) process was selected and accepted by the community.

1999 NTWWA Conference And Annual General Meeting Wrap Up

By Kojo O. Kumi, P.Eng.

The Conference and AGM Announcement included the following " Cambridge Bay is host Community to the Northern Territories Water and Waste Association's last Annual General Meeting and Conference of this millenium. Be a part of it. Conference dates are December 4 & 5, 1999. The Mayor, Council and Administration plan a lavish welcome for an expected 40-60 delegates, Join us in this celebratory event; encourage a colleague or two to attend the AGM and Conference with you. "

The fifty plus delegates at the conference opening were not disappointed. They enjoyed an excellent program of professional development presentations, site visits and traditional Cambridge Bay hospitality. Feedback and comments from delegates ranged from " this is a well organized conference" to " this is the best NTWWA AGM and Conference, I have ever attended".

The success of the Conference and AGM may lie in the full spectrum/complement of activities that was offered. The agenda included an opening reception, Trade Show, Site Visits, a superb technical presentation package, catered coffee breaks, etc.

The Regional Superintendent of Community Government and Transportation for the Kitikmeot arranged for dancers to entertain delegates to a Western Style Drum Dance; and at his invitation "half of the town" showed up to welcome the Conference delegates at the Drum Dance. It was a delightful and memorable occasion.

Of note at the conference and AGM were the following:

- There were practically no empty seats in the house for each and every technical presentation;
- A delegation of students from the Local High School attended the conference as guests of NTWWA. The students captured some of the technical presentations on a video camera. For information on the video, email Kojo Kumi @ kkumi@gov.nu.ca;
- EBA, FSC and Urecon setup booths to add a Trade Show Component to the Conference and Annual General Meeting;
- A CBC reporter covered the conference; and interviewed a cross-section of delegates and members of the executive;
- A Career Development Officer and a High School Teacher volunteered their time and catering skills to prepare and serve delightful treats at the coffee breaks;
- A first time delegate, to the Conference and AGM, who was willing to serve and contribute was acclaimed as the Vice President; and
- By design or accident, the majority of delegates did not leave town until after the Annual General Meeting. The high attendance may partially explain why nominations exceeded the two vacancies on the Board. In any event, the delegates cherished the opportunity to cast a ballot to fill the two Directorships.

The Host Community Organizing Group is indebted to: all the delegates for attending the conference, the authors for the high quality professional development presentations, session chairs, supporters and volunteers for a job well done, the traditional sponsors & sponsors of the coffee breaks, and to the Mayor, Council and Administration of the Hamlet of Cambridge Bay for the excellent host community contributions and support in the form of services, the use of community facilities and vehicles.

Special thanks go to Kim Smith and Korrine MacDonald for volunteering their time and catering skills; Elik Tologanak and the Cambridge Bay Drum Dancers and to Mr. Kane Tologanak, Regional Superintendent, Community Government and Transportation for his invaluable support and backing of the Host Community Organizing Group.

Finally, I am honoured to convey to the delegates and executive of NTWAA the appreciation and thanks of the Elders of Cambridge Bay - for the extras (food, snacks, coffee & tea supplies, soft drinks, juice, cookies and pastries) that the Association donated to the Seniors Centre. See you at the 2000 Conference and AGM.

Conference and AGM Report

By Richard Cook, Conference Chair
December 4-5, 1999

They just keep getting better year after year. The 6th Annual Conference and AGM was held in Cambridge Bay, hosted by the Cambridge Bay Host Community Group.

The Host Community Group was headed by Kojo Kumi, P.Eng. with representatives from the Department of Community Government & Transportation, the Hamlet of Cambridge Bay, the Kitikmeot Health Board and the Department of Municipal and Community Affairs.

During the course of the weekend some top-notch presentations were given on topics ranging from water supply and treatment, sewage treatment, solid waste management and environmental assessment.

We also were treated to talks by several prominent Inuit agencies, including the Nunavut Impact Review Board, Nunavut Tuungavik Inc., the Nunavut Water Board, and the Nunavut Planning Commission. Hill Murray and Associates provided tours of its sewage treatment plant at the Northern Warning Station at Cambridge Bay.

The weekend began with a Friday evening social sponsored by the Hamlet of Cambridge Bay. It was great to see so many familiar faces, as well as new ones. Saturday night we were treated to a fine dinner, also hosted by the Hamlet of Cambridge Bay. The weekend closed with the conclusion of the annual general meeting on Sunday afternoon.

Perhaps most importantly (if you like food as much as I do), the meals were delicious, and coffee break food was not just your standard fare, as we were treated to some country foods including cold smoked arctic char, muskox, and caribou.

With 55 participants, plus a couple of students from the local high school, this is our best attended conference outside of Yellowknife. Kojo Kumi and the Community Host Group, as well as the conference presenters and our members in attendance made that happen, and I thank everyone for making a good thing even better.

Our strength is in our membership, and as the Association grows and matures it is reassuring to see everyone make the commitment to attend. This year like any other, we have seen people travel great distances, from Inuvik and Grise Fiord for example, to be at the AGM.

In attending training programs, the conference and the AGM, not only are we learning something, we are acknowledging the importance of our jobs and showing pride our work. I can say that personally I have enjoyed getting to know people of the membership that I have met in the last four years.

I am also a whole lot more comfortable speaking in front of everyone than I was at my first NTWWA conference four years ago ᑐ. And I always end the weekend with a better understanding of working in the North.

Looking ahead to next year, we will be hosting our conference and AGM in the western arctic. Communities interested in hosting the event next December are encouraged to submit a proposal by March 31, 2000. The default location of the conference is Yellowknife.

Thanks again to organizers, presenters and attendees. I look forward to seeing everyone next year.

NTWWA Sponsorship

The NTWWA would like to acknowledge the excellent support provided by the following organizations:

Department of Municipal & Community Affairs, GNWT
Department of Community Government & Transportation, Government of Nunavut
North West Company
Hamlet of Cambridge Bay
Hamlet of Taloyoak
Hamlet of Pelly Bay
Adlair Aviation Ltd.
Natik Plumbing and Heating
Bank of Nova Scotia
Ferguson Simek Clark

Protecting The Aquatic Quality of Nahanni National Park Reserve, N.W.T.

by Douglas Halliwell, P. Geol. Atmospheric & Hydrologic Sciences Division
Environment Canada and Steve Catto, Nahanni National Park Reserve Parks Canada

The challenge of water resource protection in the north is to prevent environmental degradation that has occurred elsewhere due to encroaching development.

Nahanni National Park Reserve (NPR) is located in the South Nahanni River (SNR) basin, an area which also has considerable mining potential. This potential mining activity in tributaries of the South Nahanni River outside the Park raises concerns about possible degradation of Park waters.

Baseline water, sediment and fish tissue quality data were collected throughout the Park during an intensive 1988-91 study and a follow-up 1992-97 monitoring program. The two programs describe the natural and anthropogenic variability of aquatic quality in space and time in order to help evaluate the health of this sub-arctic ecosystem.

Observed values of variables were compared to the appropriate Canadian Council of Ministers of the Environment Water and Sediment Quality Guidelines for protection of freshwater aquatic life and drinking water.

Site-specific short and long term water and sediment quality objectives developed in 1991 were refined in 1997 to provide water managers with improved tools to better assess any fluctuations in aquatic quality beyond the limits of natural variability.

Such natural variability is due to flows, seasons, extreme events, and other factors. The 1992-97 monitoring program provides the aquatic quality data necessary for evaluating compliance with objectives.

The Park water and suspended sediment is of high quality, and pristine to near-pristine, overall. Park waters can be characterized as naturally conductive, weakly alkaline, highly coloured, turbid, hard, and rich in suspended and dissolved solids. Certain metal levels are naturally elevated in Nahanni NPR waters, suspended sediments, and fish tissue (e.g. livers and gills) due to high local geochemical and biochemical backgrounds.

Zinc, cadmium, copper, and iron in particular appear to be naturally elevated above national guidelines. While the aquatic ecosystem of the South Nahanni River basin appears to have largely adapted to these natural stressors, the already-stressed ecosystem may be vulnerable to future anthropogenic stress from mining and other human activities.

Incorporation of water and sediment quality objectives into the ecological management plans of the Park and the entire South Nahanni watershed is imperative to preservation of the Park's aquatic ecosystem.

Aquatic quality monitoring activities should continue at present levels, and be increased if new development occurs in the South Nahanni River basin, such as start-up of a metal mine on Prairie Creek, re-opening of the Tungsten Mine, or development of mineral deposits upstream of the Park.

Natural catastrophic events (e.g. floods, debris torrents, earthquakes, landslides, avalanches) are known to cause spatio-temporal variability in water quality, and warrant additional post-event monitoring.

Acknowledgements: The authors relied heavily on information from the 1991 report entitled "Protecting the Waters of Nahanni National Park Reserve, NWT". Contributions to that report were made by Jesse Jasper, Scott McDonald, John Kerr, Chris Spence, Mark Dahl, Gerry Wright, Pat Wood, Roger Pilling and Dale Ross of Environment Canada, and Rob Prosper of Canadian Heritage, Rob Prosper and Carl Lafferty of Parks Canada, Dr. Charlie Jefferson of the Geological Survey of Canada.

A Report on the CWWA Activities

by Robert Phillips, CPHI(C), Health Officer, Kitikmeot Health & Social Services

The Canadian Water and Wastewater Association (CWWA) held their Fall Meeting of the Board of Directors in Saskatoon on October 16th, and 17th, 1999, followed by the Annual General Meeting on October 18th. The meeting was held in conjunction with the Western Canada Water and Wastewater Association (WCWWA) Annual Conference. I had the good fortune to attend both as the NTWWA representative. To keep you abreast of recent CWWA activites, I have prepared the following summary...

Bill C-14, the Drinking Water Materials Safety Act, died on the Order Paper in September 1998 and was not carried over to the next Session of Parliament on October 12, 1999. The Bill would have regulated from a health perspective all materials coming into contact with drinking water... that is, drinking water treatment devices, chemicals and components.

CWWA supported the Bill in communications with the Hon. Alan Rock, Minister of Health, as well as in meetings with Senior Officials of the Department. The Bill was also supported by the Canadian Institute of Public Health Inspectors, Consumers Association, and Pollution Probe.

However, considerable opposition to the legislation was mounted by a self-styled "Coalition for Safe Drinking Water Systems" comprised of manufacturers of plumbing system components and point-of-use/entry drinking water treatment devices. CWWA has recently sent another letter to the Minister supporting the initiative and stating its position that the legislation should continue.

Bill C-32, An Act to Amend the Canadian Environmental Protection Act (CEPA), was passed by the House of Commons in June. The Act was given Royal Assent on September 14, 1999. The amendment would significantly shift the federal environmental protection program activities to pollution prevention but will continue to provide for response mechanisms when pollution has occurred, either through manufacturing processes or through accidental releases. CWWA has submitted a Brief to the House of Commons Committee to clarify the manner of determining and declaring the toxicity of a substance, and to recognize the role that municipalities can play in pollution prevention and environmental protection.

Since the Royal Assent, the Minister of the Environment has announced $72 million in new funding to conduct scientific research into toxic substances that harm human health and the environment. CEPA establishes strict guidelines for controlling toxic substances, and requires the virtual elimination of the most dangerous. CWWA has submitted its position on five different substances including ammonia in the aquatic environment , aluminum salts and chloramines.

It is likely that they will be found to be toxic by CEPA necessitating the establishment of a management plan. The first will require action by all wastewater systems in Canada, and the last two will affect all waste treatment systems. Chlorinated wastewater effluent has already been declared toxic (but not to humans) at the end of the Priority Substance List 1 review of 1993.

CWWA has submitted comments to Health Canada on the proposed aluminum guidelines for drinking water. Aluminum, as you know, has been linked to Alzheimer's disease.

The decision was to leave the parameter as an operational guideline of 100 ug/L for conventional plants, 200 ug/L for lime softening and other plants but under no circumstances to compromise disinfection safety in an attempt to reduce aluminum residuals.

CWWA has also submitted comments on the proposed guideline for protozoa (Giardia and Cryptosporidium). The Federal Provincial/ Territorial Drinking Water Committee has decided not to set a numerical limit, and is preparing an "It's

Your Health" pamphlet on the issue. For your information, since 1998, Nunavut and NWT have had 16 cases of Giardia and 2 cases of Cryptosporidium.

A great deal of time at the CWWA Board of Director's Meeting was devoted to developing a series of policy and position statements on a number of important aspects on water and wastewater management operational issues. The following have been finalized and are available for those interested in receiving a copy

- Boil Water Advisories
- Legislation Respecting Drinking Water Materials Safety
- Disinfection of Municipal Effluents
- Point-of-Use/Point-of-Entry Treatment Devices
- Bottled Water

An updated version (April 1999) of the Summary of Guidelines for Canadian Drinking Water Quality is now available on the Health Canada web page at www.hc-sc.gc.ca/ehb/ehd/bch

For more information on CWWA, visit their home page at www.cwwa.ca or contact the undersigned at (867) 983-7345 (fax) 983-3028, or by e-mail at rphillips@gov.nu.ca

Respectfully submitted,
Robert Phillips, CWWA Rep (NTWWA)

Get involved with CWWA's

Initiative for the Reduction of Toxic Materials in Municipal Wastewater Systems.

There is considerable public and governmental concern about the quantity and variety of toxic substances in municipal wastewater systems.

Municipal sewer systems receive and collect commercial, domestic, industrial and institutional effluents and transport them to sewage treatment plants (STP) for treatment prior to their discharge or disposal in the environment as treated wastewater or as sludge. Often, commercial and industrial effluent streams has properties or contain substances which should not enter the STP processes.

Municipalities have a key role to play in both the prevention of pollution and the protection of the environment. Reducing the number, quantity and concentration of substances entering sewer systems and sewage treatment plants will improve the success of treatment processes and will improve the quality of STP effluents and sludges.

A program focussed on the management of toxic substances, effluents, and sludge involves a dual approach:

- to reduce the use and generation of toxic substances from municipal programs by means of treatment process management and/or the introduction of new technologies *(get our own house in order)*; and
- the use of municipal by-law authority to prevent commercial and industrial from discharging toxic substances *(get our residents' houses in order)*.

Commitment

CWWA has proposed to Environment Canada and to the Canadian Council of Ministers of Environment, that there are five management tools in particular that might be developed and made available to all municipal wastewater system managers that would be of benefit generally.

CWWA and its seven member Regional Associations, which includes our own NTWWA, are committed to the development and implementation of waste management/toxic reduction strategies by municipalities and their residents.

We wish to work in a collaborative effort with Environment Canada, the Provinces and Territories and commercial, professional and other Associations to develop strategies and tools to implement a toxics reduction program within the municipal context.

Municipal wastewater system managers (CWWA's members) and their staff deal with all the significant

elements of the dual approach at the technical and professional levels. The parts encompass substances:

- θ discharged into municipal sewer systems,
- θ used and generated in sewage treatment plants and processes,
- θ in atmospheric emissions from sewage treatment plants,
- θ in the effluents of sewage treatment plants, and
- θ in the biosolids and sludges created during sewage treatment processes.

These five parts are the **effluents management program**, part of Environment Canada's toxics program.

CWWA's members are responsible for:

- θ providing the technical advice leading to the promulgation of by-laws on effluent discharges into municipal sewer systems,
- θ approving technical specifications for treatment plant tendering, construction and operation,
- θ process management activities in existing plants and systems including environmental discharges from those plants and systems, and for
- θ meeting provincial, territorial and federal emission, effluent and waste disposal standards.

The municipal effluents management program

The municipal effluents management program will enhance the use the operational and regulatory activities and powers of municipalities to reduce the discharge into sewer systems or the generation within sewer treatment plants of substances hazardous to the environment and public health.

Essential Elements for Effluents Management

To be successful, municipal wastewater system managers need to know:

- θ what substances are likely to be present in sewer systems, their potential sources
- θ how they can be detected;
- θ if and how they can be removed from discharges to sewers;
- θ if and how they can be treated in the sewage treatment plant; and
- θ what strategies can be applied to encourage the reduction in use, discharge or generation of substances hazardous to the environment in business enterprises.

While there a considerable amount of information is available, it has not been compiled into readily accessible and useable Guides - a matter of considerable and inverse importance to the size of the municipality, i.e, smaller municipalities have greater need for assistance in identifying problems and solutions in the management of toxics in effluent streams than larger ones.

The municipal effluents management program requires therefore the development of a number of management tools, a strategy for implementation and an awareness program.

The following lists five specific tools essential to the majority of municipalities if they are to participate effectively in an effluents management activity. These tools would also be useful to other stakeholders in the management of toxic substances generally, including the smaller industrial and commercial enterprises, government inspectors, and others. The suggested tools are:

1. **A *Directory of Probable Sources of Contaminants Entering or Likely to Enter Municipal Sewer Systems*** would show the substances that could be discharged from an activity, and the potential source of a discharge.

   This should help municipalities identify what substances result from industrial and commercial activities. It could be used for By-law generation and enforcement, treatment plant design and operation, and effluent monitoring purposes. Smaller scale industrial and commercial enterprises might also use this to develop their own environmental management programs.)

   CWWA and its members would collect and assemble information available from municipalities and other sources. CWWA's goal is to collect from as many sources as possible, whatever knowledge may be available that **activity X** is likely to discharge **substance(s) Y (and Z)** into a sewer; and to compile this information and relate it to the **North American Industrial Code** and to the **Chemical Abstracts Service** nomenclature..

2. A national standard for ***Wastewater Interceptors and Pollution Control Processes*** addressing construction and performance standards. CSA International would be asked to establish a Technical Committee to develop the standard

This tool would set out standards for the construction and performance of processes used to treat industrial and commercial waste prior to discharge to the municipal systems.

3. Environment Canada through its Wastewater Technology Institute would be asked to develop a ***Catalogue of Sewer Treatment Plant Technology and Processes*** identifying and describing current known technologies and treatment processes to remove or neutralize substances likely to enter treatment plants. *(Intended use: identify and summarize known solutions to current contaminant problems.)*

4. Environment Canada through its National Water Research Institute and Health Canada through its Drinking Water Laboratory would be asked to assemble a ***Catalogue of Effluent Monitoring Devices and Techniques*** identifying and describing current known devices and techniques that can be used to detect the presence of substances in sewer systems.

   This would be used to assist municipalities monitor discharges to sewers by industrial and commercial establishments. This would also be of use to smaller industrial and commercial enterprises for their own monitoring responsibilities.)

5. CWWA and its members would collect and assemble information available from municipalities and other sources to develop a municipal **Strategy Paper on Model By-law and Programs for the Prevention of Pollution**.

   This paper would indicate the options and experiences available to municipalities in the design and implementation of a prevention of pollution program for industrial and commercial activities within their jurisdiction. *(Intended use: guide municipalities in selecting strategies suitable for use in their respective situations to encourage and ensure reduction in the use and generation of toxic substances.)*

Provincial and Territorial Government Agencies would be asked to contribute information and knowledge as they can and otherwise participate in the various tool development activities.

Associations representing key industrial and commercial sectors (in the interests of assuring and enhancing the environmental performance of their members and their respective sectors) would be asked to contribute knowledge and advice in the development of all the tools, and would, assist in the distribution of the information to their own clientele and members.

As the tools, intended to be public domain documents, become available, CWWA and its member Regional Associations working with the Federation of Canadian Municipalities and the Provincial and Territorial Unions of Municipalities would embark on an awareness program to their members of the opportunities to use the tools to develop and implement an effluent management program in the municipal sector.

Other stakeholders would perform similar and parallel functions with respect to their own clientele and membership

If you would like to become involved with this important program contact or Robert Phillips at (867) 983-7345 (fax) 983-3028, or by e-mail at rphillips@gov.nu.ca

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Don't forget that it's time to send in your CEU's for 1999. Use the handy form included with the Newsletter.

CWWA Policy and Position Statement

Boil Water Advisories.

Policy:

The Canadian Water and Wastewater Association encourages municipalities to monitor continuously the microbiological quality of their finished water and where the quality may be compromised, to cooperate fully with local health authorities to provide appropriate notice to the community while instituting remedial actions to restore the quality to acceptable standards.

To achieve this, the Association encourages municipalities to establish at the local level, a water quality team comprising those responsible for source water protection, water treatment and distribution, water quality monitoring and public health surveillance.

Position:

It is the position of the Association that despite the best efforts of water utilities to provide safe water, on rare occasions water quality may be compromised by microbiological hazards. This may result from a number of environmental or technical causes which can be best identified or prevented by the continuous monitoring of raw water quality, treatment processes and distribution systems.

The creation of a water quality team comprising persons responsible for source water protection, water treatment and distribution, water quality monitoring and public health will allow for the rapid exchange of information so that appropriate notices can if necessary be issued to the public and so that remedial measures that may be required in the watershed, at the treatment plant or in the distribution system can be instituted without delay. The team should also have criteria in place to determine when an Advisory can be rescinded

Recent research indicates that holding water at a rolling boil for a period of one minute will inactivate all waterborne pathogenic microorganisms.

While such notices may or will be issued by the community's public health representative where routine testing of finished water indicates the presence of protozoa cysts or where clinical evidence shows that gastrointestinal complaints are widespread and abnormal in frequency, the water utility is likely and should be able to detect conditions in advance of the epidemiological evidence of deteriorating water quality. CWWA recommends that the water quality team be directly involved with the day to day operations of the water utility. The water utility can and should be able to anticipate the possibility of a public health risk.

Summary statement:

Despite the best efforts of water utilities, on rare occasions environmental or technical conditions will arise that may prevent {result in} the distribution of microbiologically safe {unsafe} water. The water utility should be able to detect these conditions ahead of epidemiological evidence. Water utilities should establish a local water quality team comprising those responsible for source water protection, water treatment and distribution, water quality monitoring and public health.

This will allow the rapid exchange of information so that appropriate notices can be issued if necessary to the public and so that remedial measures that may be required in the watershed, at the treatment plant or in the distribution system can be instituted without delay. The team should also have criteria in place to determine when an Advisory can be rescinded

Relevance:

Microbiological hazards can occur from a number of environmental or technical conditions affecting any water utility drawing water from a surface water source or an unprotected shallow aquifer, and will be higher in the Spring, Summer or Fall. As a result, most water utilities face the problem of controlling microbiological risks and it is estimated that more than 22,000,000 Canadians consume water from such sources.

Issuance of a boil water Advisory has very significant impacts on the community - confidence in the public water supply falls and there are impacts on tourism, and there is the cost of providing substitute water

supplies (bottled water to schools, old-age residences, etc.). Boil water Advisories can be avoided in many circumstances by attention to source water conditions, treatment and distribution system operations.

Stakeholders:

- owners and operators of water treatment facilities drawing on water from surface or unprotected shallow aquifers,
- elected officials in such municipalities,
- residents of such municipalities,
- public health officials, and
- provincial regulatory staff.

Additional commentary and information:
On rare occasions and for various reasons, finished water drawn from surface water sources or unprotected aquifers may be compromised by microbiological hazards. At such times, it is appropriate, in addition to attempting to immediately return the treatment process to normal conditions, to provide the community with a notice to boil water prior to consumption. Decisions concerning boil water advisories should be made at the local level based upon site-specific knowledge and conditions and only by a local health authority. In some circumstances, utilities may wish to consider issuance of a public statement as a means of demonstrating due diligence. Recent research indicates that holding water at a rolling boil for a period of one minute will inactivate all waterborne pathogenic microorganisms.

A water quality team comprising those responsible for source water protection, water treatment and distribution, water quality monitoring and public health surveillance should be in place to quickly respond to any drinking water-related incident that has had or may have had an affect on water quality or public health. This arrangement allows for the rapid exchange of information so that remedial measures that may be required in the watershed, at the treatment plant or in the distribution system can be instituted without delay. Depending on the seriousness of the incident the public health representative or other designated member of the team may issue a boil water Advisory. The team should also have criteria in place to determine when an Advisory can be rescinded. The arrangement should also allow for prompt communication of the Advisory and related health risks to elected officials, the news media and the public.

The water quality team should foster and promote public health by being alert to potential microbiological problems with water supplies whenever there is evidence that any of the following conditions may have occurred or apply:

1. significant deterioration in source water quality,
2. equipment malfunction during treatment or distribution,
3. inadequate disinfection or disinfection residuals,
4. unacceptable microbiological quality (based on local conditions and experience),
5. unacceptable turbidities or particle counts (based on local conditions and experience); or
6. where epidemiological evidence indicates that the drinking water is responsible for an outbreak of illness.

Potential trigger conditions include the presence of coliforms at rates greater than 10 total coliforms per 100 mL and the presence of cysts at rates greater than 10 cysts/1000L (1 cyst/1000/L should be the goal of water treatment). An Advisory should be issued where the rate is greater than 100 cysts/1000, but never on the basis of high turbidities or particle counts alone. Sampling procedures should be constantly reviewed to ensure accuracy and non-contamination.
The possible negative consequences of boil water Advisories, for example, the risk of scalding, especially to young children and elderly people should also be considered.

Communications issued by the water utility in connection with a Boil Water Advisory could include the following:

1. a statement regarding the believed or known cause of the problem creating the unsafe water condition,
2. advise that holding water at a rolling boil for a period of 1 minute or more is known to render the water microbiologically safe,
3. provide a caution on the risk of scalding particularly for young children and the elderly,
4. indicate what steps are being taken by the utility to remedy the situation, and
5. advise when it is expected that the situation will be remedied.

The communication could also indicate the date, duration and cause of the last Advisory, if any.
Boil water Advisories are usually rescinded as soon as the microbiological quality, turbidity, particle counts, or disinfection residual of the treated water in at least two consecutive sets of samples have returned to acceptable levels or when the treatment or distribution malfunction has been corrected and

sufficient water displacement has occurred in the distribution system to eliminate any remaining contaminated water. In the case of an outbreak, Advisories are usually rescinded after the above conditions have been met and when surveillance indicates that the incidence of the illness in the community has returned to background levels. Owing to lengthy incubation periods for some pathogens and their secondary spread, new cases of illness may occur after the period of contamination has passed. It should be noted that a lack of new cases may indicate that the Advisory is being followed and not that the causative situation has been rectified.

Due Diligence Under Attack

Environmental offences are referred to as "strict liability offences". The analogy is a speeding ticket. once charged, you are guilty unless you can prove that there where extenuating circumstances that should excuse you.

For environmental offences, once the Crown has proven that an incident has occurred (such as a spill or illegal discharge) the accused must prove "due diligence" or that it did everything that it could to prevent the incident, in order to avoid a conviction.

If all due diligence was taken and the offence happened anyway, the no one is at fault and the accused will not be convicted.

In presentation of a due diligence defence, the accused often calls witnesses to testify that appropriate preventative measures were taken. Records would be produced to demonstrate that liabilities were assessed and action plans were put in place. Such documents include environmental manuals, checklists for the use of staff at sites, maintenance management systems, or through external audits of procedures and activities.

In many cases, the Crown attempts to improve its case by calling witnesses or presenting documentary evidence to show that the defendant was not duly diligent. In Canada, the accused does not have to disclose its defence material to the Crown which puts the Crown at a disadvantage since the accused always has a more intimate knowledge of its operations.

A recent Supreme Court of Canada decision has changed this. The Supreme Court found that denying the Crown the ability to gather evidence in anticipation of a due diligence defence would have "serious consequences" on the function of the justice system. Now the Crown is permitted to use search warrants to seize any and all pertinent documents.

Certainly, the lack of documents will be argued as a lack of due diligence.

The decision of the Supreme Court of Canada has implications for the northern municipalities still reeling from the Iqaluit Sewage Case. Simply following the conditions of a valid Water Licence will not be a successful defence.

Municipalities must maintain continuous vigilance so that activities which contribute in any way to their environmental liability to conform to environmental standards. Any written record that indicates otherwise will be examined in court and potentially cause a defence of due diligence to be rejected.

Considering the Iqaluit case cost the taxpayer about $1 million dollars, among other things, the implications become staggering.

Northern Territories Water and Waste Association

Training and CEU Registration Form

In order to maintain their current certification status or apply for status upgrades, operators must register Continuing Education Units (CEU's) each year. In general, 1 CEU is equivalent to 10 contact hours of training. An operator must register 1.2 CEU's annually. There is no charge for this service. Use this handy form

Today's Date _____

Your Name _____

Your Address _____

_____

Training Program Name _____

Where Was it Held? _____

When Was it Held? _____

How Many Hours Long Was the Program? *Example answer - 3 days, 7.5 hours per day, or 22.5 hours.*

If you are registering your Safety Committee Meetings as CEU's, provide the following information:

Month	Discussion
Example January	*Hypothermia, ladder safety, new eyewash station*
January	
February	
March	
April	
May	
June	
July	
August	
September	
October	
November	
December	

Mail the completed form to: NTWWA, CEU Registration, #5 4807 49th Street, Yellowknife, NWT.