Agenda - Executive Policy Committee - October 20, 2004

Report - Standing Policy Committee on Public Works - October 12, 2004

Item No. 4 Water Treatment Program - revision to Chloramination Implementation Schedule
File WS-7

STANDING COMMITTEE RECOMMENDATION:

On October 12, 2004, the Standing Policy Committee on Public Works concurred in the administrative recommendation and submits the following to Council:

1. That the implementation schedule for the Water Treatment Program originally approved by Council on November 12, 2000 and subsequently amended by Council on July 17, 2002, be further amended so that the Chloramination Facility is deferred from 2005 to 2007 and commissioned concurrent with the balance of the water treatment plant.

2. That the Proper Officers of the City be authorized to do all things necessary to implement the intent of the foregoing.

Agenda - Executive Policy Committee - October 20, 2004

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DECISION MAKING HISTORY:

STANDING COMMITTEE RECOMMENDATION:

On October 12, 2004, the Standing Policy Committee on Public Works concurred in the administrative recommendation and submitted the matter to the Executive Policy Committee and Council.

COUNCIL:

On July 17, 2002, Council concurred in the recommendation of the Standing Policy Committee on Public Works and adopted the following:

1. That the baseline water treatment process approved by Council be amended to include ultra violet (UV) light disinfection.

2. That the schedule for implementation of water treatment approved by Council be amended to facilitate staged implementation, with construction of a UV disinfection facility to be operational in 2004, construction of a chloramination facility to be operational in 2005, and construction of the balance of the water treatment plant to be operational in 2007.

3. That membrane filtration not be considered for water treatment in Winnipeg, due to the high cost of the technology.

On November 22, 2000, Council concurred in the recommendation of the Executive Policy Committee and adopted the following:

1. The City proceed with treatment of the water supply as described herein.

2. Design and construction activities be undertaken so that the water treatment plant be operational in the year 2006.

3. That the water treatment process as identified through the pilot testing and described herein be adopted as the baseline process for comparison to alternatives and new technologies.

4. The Administration:
   a) Investigate and report on emerging technologies such as ultraviolet disinfection and membranes;

Report - Standing Policy Committee on Public Works - October 12, 2004

DECISION MAKING HISTORY (Continued):

b) Investigate and report on alternative project delivery strategies;

c) Prepare documents in support of any application by Council for Federal and Provincial funding.

RE: WATER TREATMENT PROGRAM - REVISION TO CHLORAMINATION IMPLEMENTATION SCHEDULE

FOR SUBMISSION TO: Standing Policy Committee on Public Works

ORIGINAL REPORT SIGNED BY: Barry D. MacBride, P.Eng.
Director
Water and Waste

REPORT DATE: September 24, 2004

RECOMMENDATION(S):

That the implementation schedule for water treatment program approved by Council be amended so that the Chloramination Facility is deferred from 2005 to 2007 and commissioned concurrent with the balance of the water treatment plant.

REPORT SUMMARY

KEY ISSUES:

Power failure at the Deacon facility will result in interruption in the operation of the UV disinfection. Free chlorine must be used to inactivate pathogens such as Giardia during these events. Accordingly, Chloramination must be deferred to guard against exposure to pathogens.

IMPLICATIONS OF THE RECOMMENDATION(S):

General Implications

	None
	For the organization overall and/or for other departments
X	For the community and/or organizations external to the City of Winnipeg
	Involves a multi-year contract

Comment(s):

- Delay of construction of Chloramination will prolong exposure to levels of disinfection byproducts in the water supply that exceed the Canadian Drinking Water Guidelines. However, the acute risk of waterborne pathogens during power outages is of greater concern.

Policy Implications

X	No
	Yes – Comment(s):

Environmental Implications

X	None

	Yes – Comment(s):

Human Resources Implications

X	No
	Yes – Comment(s):

Financial Implications

X	Within approved current and/or capital budget
	Current and/or capital budget adjustment required
	Comment(s):

REPORT

REASON FOR THE REPORT:

Council must approve the proposed change to the water treatment program schedule.

HISTORY:

1993 Council approved the creation of the Water Treatment Reserve Fund to cash finance a portion of the cost of a water treatment plant.

2000 On November 12, Council adopted the following recommendations:

5. *The City proceed with treatment of the water supply as described herein.*
6. *Design and construction activities be undertaken so that the water treatment plant be operational in the year 2006.*
7. *That the water treatment process as identified through the pilot testing and described herein be adopted as the baseline process for comparison to alternatives and new technologies.*
8. *The Administration:*
   a) *Investigate and report on emerging technologies such as ultraviolet disinfection and membranes;*
   b) *Investigate and report on alternative project delivery strategies;*
   c) *Prepare documents in support of any application by Council for Federal and Provincial funding.*

2002 On July 17, Council adopted the following recommendations:

1. *That the baseline water treatment process approved by Council be amended to include ultra violet (UV) light disinfection.*
2. *That the schedule for implementation of water treatment approved by Council be amended to facilitate staged implementation, with construction of a UV disinfection facility to be operational in 2004, construction of a*

chloramination facility to be operational in 2005, and construction of the balance of the water treatment plant to be operational in 2007.

3. *That membrane filtration not be considered for water treatment in Winnipeg, due to the high cost of the technology.*

2003 On June 25, Council adopted the following recommendation:

It is recommended that the "construction management" project delivery strategy be utilized for design and construction of the water treatment plant, and that City forces operate the facility.

2004 On July 21, Council adopted the following recommendations:

1. *That the water treatment plant (WTP) design capacity be set to provide a treated water capacity of 400 million litres/day (ML/d).*
2. *That the Proper Officers of the City be authorized to do all things necessary to implement the intent of the foregoing.*

DISCUSSION:

The water treatment proposal approved by City Council in November 2000 was designed to provide protection against C*ryptosporidium* and to reduce the level of disinfection by-products to meet current and future Canadian drinking water guidelines. The proposed treatment plant will also improve the taste and odour associated with algae in the water.

Subsequent water industry research on the application of ozone in cold water resulted in a change in the design standards (a significant dose increase) for C*ryptosporidium* inactivation. Further research demonstrated that Ultraviolet light (UV) disinfection is effective for Shoal Lake water, and that it is more economical to use UV disinfection for pathogen control than to increase the capacity of the ozone step.

Accordingly, it was recommended that UV disinfection be integrated into the baseline water treatment process. In this process train, UV disinfection is used for pathogen control, and it is not necessary to increase the size of the ozone step to inactivate *Cryptosporidium*. Ozone is still required for virus control and filter performance; and will significantly improve taste and odour.

The chlorine added to the water for disinfection reacts with organic material found naturally in Shoal Lake water to form chemical compounds called trihalomethanes (THMs). Studies show an association between long-term exposure to high levels of the THMs and cancer. The Canadian Drinking Water Guideline for THMs is 100 ug/L. During 2003, the average level of THMs in Winnipeg's drinking water was 118 ug/L and the maximum level was 166 ug/L.

Research concerning alternative disinfectants that could be used in conjunction with UV disinfection of unfiltered Shoal Lake water demonstrated that disinfection of the water delivered to distribution system using chloramines (with UV) was viable and would reduce THMs to just

below the current Canadian drinking water guideline of 100 parts per billion (ppb). Changing disinfectants from chlorine to chloramines earlier would provide some benefit to customers because of the reduced THM levels.

Accordingly, in 2002 Council, approved an amended strategy pursuant to the outcome of research on UV disinfection and alternative disinfectants, as follows:

- Construct a UV disinfection facility in 2004 advance of the full Water Treatment Plant to enhance pathogen control to protect public health.
- Convert the water distribution system to use chloramines instead of chlorine to reduce the current level of disinfection by-products, after the UV disinfection facility is commissioned but prior to constructing the full Water Treatment Plant.
- Continue to accumulate funds in the Water Treatment Plant Reserve by delaying the full Water Treatment Plant in-service date by one year to late 2007, to permit funding of the UV disinfection facilities.

The baseline water treatment process including UV disinfection is shown on Figure 1 below:

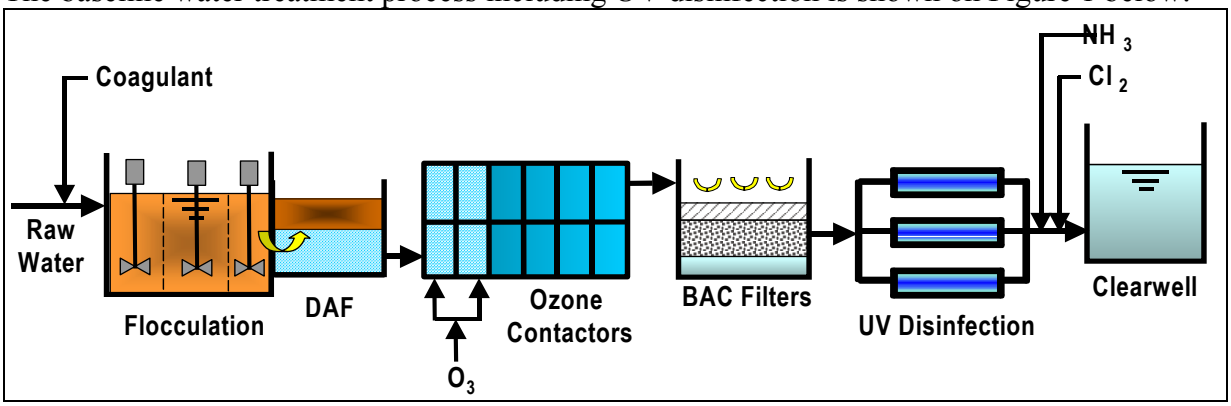

Figure 1: Baseline Water Treatment + UV Disinfection Schematic

Design of the UV disinfection facility has been completed and construction of facility is under way. The project is on schedule for completion by the end of 2004 and below budget. Once the UV disinfection facility is complete and commissioned, it will provide increased protection against waterborne pathogens such as Giardia and Cryptosporidium.

Conversion of distribution system disinfection from chlorine to chloramination was originally contemplated to occur immediately after the City gained confidence in the operation and performance of the UV disinfection system. The department directed the Design Consultant responsible for the water treatment program to review this concept and provide a letter report concerning risks and benefits. With respect to converting the distribution system prior to the Water Treatment Plant coming on-line, the project consultant has identified a number of issues that need to be considered. These include:

Water Supply Safety - Converting to chloramination prior to the Water Treatment Plant can increase the risk of unsafe water entering the distribution system during power failure conditions. Specifically, during power outages the UV system would not be operational.

Should Giardia be present in the raw water, primary disinfection would be compromised, as chloramines are relatively ineffective in Giardia inactivation compared to chlorine. It is not feasible to shut off the flow of water to the branch aqueduct system during a power outage. The time required to accomplish this is such that a "slug" of untreated water would enter the branch aqueducts. Alternatively, the risk could be mitigated with emergency backup power and temporary discontinuation of ammonia feed (i.e. return to free chlorination). However, the reliability of the system would be diminished and it may not be possible to ensure adequate disinfection. Further, customers would experience a measurable variation in water quality during these events.

The impact of power failures will be minimized when the Water Treatment Plant is in operation due to emergency power systems and controls and the multiple barriers in the treatment process.

- **Impact on Consumers -** Converting to chloramination prior to the Water Treatment Plant will result in two changes in distribution system water quality, initially at the time of chloramination conversion and later at the time of Water Treatment Plant commissioning. Each of these events will require a significant distribution system monitoring program and could result in potential short-term water quality issues. Costs and potential problems would be minimized by delaying chloramination conversion to occur concurrent with Water Treatment Plant start-up so that only one water quality change is introduced into the distribution system.

- **Coordination with Distribution System Flushing** - Flushing of the distribution system is ongoing and should be completed just prior to commissioning of the Water Treatment Plant. Flushed and non-flushed distribution piping may react differently to a change in water quality. It is considered prudent to delay chloramination conversion until the distribution system flushing program is completed to mitigate any localized adverse effects.

Delay of construction of chloramination will prolong exposure to levels of THMs in the water supply, which exceed the Canadian Drinking Water Guidelines, by two years. Chronic exposure to these levels of disinfection by-products poses a low long-term health risk. However, the acute risk of waterborne pathogens during power outages is of greater concern.

Therefore considering the benefits and potential risks of converting the distribution system to chloramination prior to start-up of the Water Treatment Plant, it is recommended that the implementation schedule for water treatment approved by Council be amended so that the Chloramination Facility (originally scheduled for operation in 2005) is deferred and becomes operational concurrent with the balance of the Water Treatment Plant, in 2007.

Once the UV disinfection facility is complete and commissioned, it will provide increased protection against waterborne pathogens such as Giardia and Cryptosporidium. If as recommended, free chlorination is left in place instead of converting to chloramination, the level of protection against waterborne pathogens during power outages will be the same as present.

This means that a barrier (chlorine) against Giardia will exist, but there will be no protection against Cryptosporidium during power outages.

FINANCIAL IMPACT:

There is no financial impact associated with this report.

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Moira L. Geer C.A.
Manager of Finance and Administration

IN PREPARING THIS REPORT THERE WAS CONSULTATION WITH AND CONCURRENCE BY:

The Medical Officer of Health - Winnipeg Regional Health Authority and the Province of Manitoba Office of Drinking Water concur with the recommendation to delay chloramination, as outlined in this report.

THIS REPORT SUBMITTED BY:

Department: Water and Waste
Division: Engineering
Prepared by: Tom Pearson
File No. 020-18-29-01-00

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