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**FINAL**

# Memo

From: Ann Gibson
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|---|---|
| **To:** | Municipality of Brockton – Murray Clarke, Acting Director of Operations<br>Cc: Veolia Water – Scott Gowan, Project Manager |
| **Re:** | Feasibility Study: Converting the Existing Chlorine Contact Tank to a UV Disinfection System |
| **File #:** | 17182 |
| **Date:** | September 11, 2018 |

## 1.0 INTRODUCTION

### 1.1 Purpose of the Study

To address concerns related to the negative environmental and health impacts of the release of chlorine into aquatic environments, the Canadian Environmental Protection Act (CEPA) has designated inorganic chloramines and chlorinated wastewater effluents as priority toxic substances. A Pollution Prevention (P2) Planning Notice was published by Environment Canada in the *Canada Gazette*, Part I on December 4, 2004. Under the Wastewater Systems Effluent Regulations (WSER) SOR/2012-139, for systems that release less than 5,000 m³/day, based on an annual average, the total residual chlorine (TRC) standard (not to exceed 0.02 mg/L), comes into force on January 1, 2021.

Table 1 shows the existing average, maximum and total TRC (calculated based on the average TRC and total flow) released from the Walkerton Water Pollution Control Plant (WPCP), as reported in the 2016 and 2017 Summary Reports prepared by Veolia. The average TRC in both years was significantly higher than the upcoming WSER standard (0.02 mg/L).

**Table 1**
**Summary of TRC for the Walkerton WPCP**

| Year | Average TRC (mg/L) | Maximum TRC (mg/L) | Total Flow ($m^3$) | Calculated TRC (kg) |
|---|---|---|---|---|
| 2016 | 0.44 | 0.93 | 1,559,075 | 686 |
| 2017 | 0.39 | 0.83 | 1,592,231 | 621 |

Source: 2016 and 2017 Veolia Water Summary Reports

Options for eliminating effluent TRC were discussed in a June 27, 2018 memo re: Comparison of Dechlorination and Ultraviolet (UV) Disinfection at the Walkerton WPCP, attached as Appendix A. UV disinfection was considered the preferred approach to reducing/eliminating TRC at the Walkerton WPCP, as the WPCP will not use any chlorine for disinfection with this option, thus reducing the TRC to 0 mg/L.

The Municipality has received a grant from the Federation of Canadian Municipalities (FCM) through the Green Municipal Fund. This grant is awarded to support municipal feasibility studies and pilot projects for environmentally sustainable projects. According to the FCM, "successful initiatives are those that reflect the very best examples of municipal leadership in sustainable development - feasibility studies and pilot projects that are expected to lead to high environmental benefit, link to existing plans and policies, use a strong management approach, can be scaled up and replicated by other communities."

The purpose of this study is to determine the feasibility of converting the existing chlorine contact tank to UV disinfection at the Walkerton WPCP. The feasibility study will include a description of the proposed UV system, the power requirements, construction requirements, cost and the overall benefits of the conversion.

## 2.0 FEASIBILITY OF REUSING EXISTING CHLORINE CONTACT TANK

### 2.1 Description

The existing chlorine contact tank has two compartments with a Parshall flume in the center and baffled contact tanks mirrored on either side providing a total volume of approximately 294 $m^3$. The south tank has a process water reuse pump located in the east corner.

The south side of the existing chlorine contact tank can be converted to the UV disinfection system, the other side will be decommissioned. The installation of two UV banks (one duty, one redundant) requires that the existing tank baffles be removed, and new narrower channels be placed at 90 degrees to the previous flow pattern. A stilling basin will be required ahead of the UV banks to create laminar flow. After the UV banks, the remaining space in the chamber will be left at full depth to allow adequate volume of water for the process water reuse pump.

The peak design flow used to size the UV system was 21,792 $m^3$/day to accommodate future growth. The peak design flow uses the existing peak flow (18,160 $m^3$/day) scaled 20% for future growth.

The physical changes are outlined in the preliminary drawing attached.

### 2.2 Electrical Power, Monitoring and Controls

The UV facilities would require a 460-480V/3/60 power supply capable of providing 12kW. A separate 120V/1/60 supply will be required for controls. The UV system will be integrated into the WPCP's SCADA system for monitoring and alarms.

Investigations to date have not indicated that there would be issues with providing the required power.

### 2.3 Construction Timing

Ideally construction will occur during the summer months, when the influent flows to the WPCP are lower. After reviewing Annual Reports prepared by Veolia for 2016 and 2017, the lowest flows typically occur from May to November. Similar construction projects completed in the past have ranged from 5 to 6 months in length.

### 2.4 Maintenance of Treatment During Construction

According to the Ministry of Environment Conservation and Parks (MECP) Guidance Document (formerly MOE), the minimum contact time required for effluent chlorination is 30 minutes (15 mins at peak flow). During construction, the flow will be diverted through the north chlorine contact tank that will be decommissioned once the conversion to UV disinfection is complete.

To maintain adequate treatment during construction with one chlorine contact tank online, the maximum flow rate for 30 minutes contact time is 6,100 $m^3$/day, which accounts for 95% of the flows between May and October, based on 2016 and 2017 flows. The maximum flow rate for 15 minutes contact time at peak flows is 12,180 $m^3$/day. The frequency of flows is shown in Figure 1. Effluent flow recording has been inaccurate due to issues with the Parshall flume, therefore recorded raw sewage data (i.e. plant inflows) was used in Figure 1.

**Frequency of Flows at the Walkerton WPCP for May to October 2016-2017**

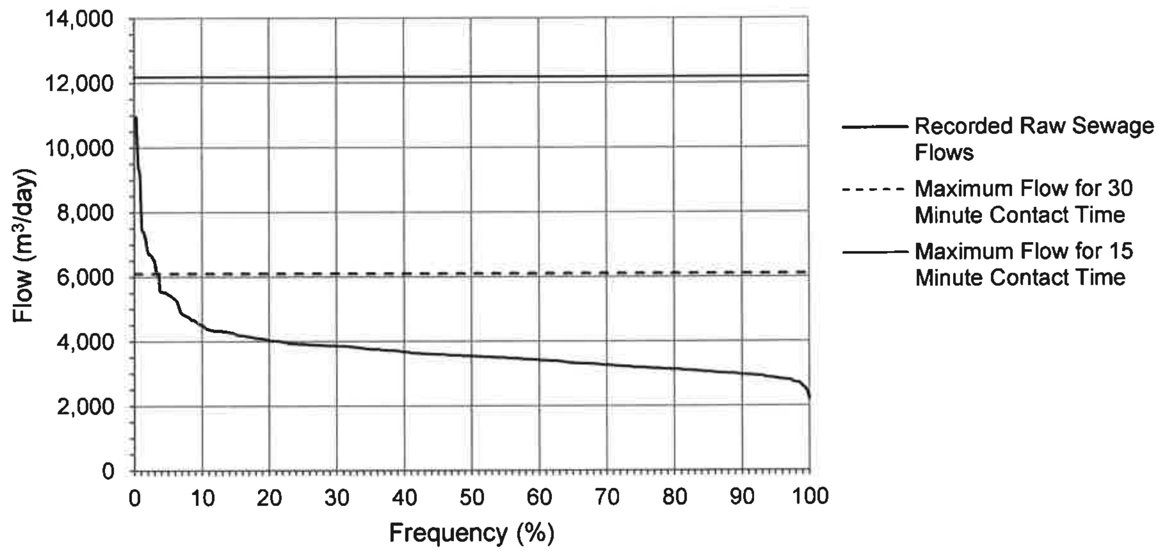


Figure 1 shows the frequency of flow values at the Walkerton WPCP for May to October 2016 and 2017.

### 2.5 Cost of Converting

#### 2.5.1 Capital Cost

Based on construction in 2018, the probable capital costs related to provision of UV disinfection are as follows.

| Item | Probable Cost |
|---|---|
| • Supply UV Equipment | $ 280,000 |
| • Installation | $ 202,000 |
| • MECP Approval Fees | $ 4,000 |
| • Engineering – Design (7%) | $ 34,000 |
| • Engineering – Contract Administration and Site Review (8%) | $ 39,000 |
| • Contingency (10%) | $ 56,000 |
| • Net HST (1.76%) | $ 11,000 |
| **Total Capital Cost (2018)** | **$ 626,000** |

### 2.5.2 Operating Cost

Based on an estimate provided by Trojan for their UV3000plus system, the annual operating costs are expected to be in the order of $32,000. This figure includes annual lamp replacement and electricity costs. It is assumed that routine monitoring and changing the UV lamps will be a similar workload to the current chlorination process. These costs will be offset in part by the elimination of chlorine supply and handling costs.

## 2.6 Overall Benefits

The benefits provided by converting to UV disinfection include:

- Eliminating TRC in the effluent and complying with CEPA;
- A similar workload for the operator in comparison to current processes;
- Achieving effluent quality requirements without chlorination;
- Reduced health and safety risks to operators through less exposure to chemicals;
- Reduced risk to aquatic life and aquatic habitat; and
- Reduced risk to the environment, in general.

These benefits are largely due to the shift away from chemical-use and the decrease in health, safety and environmental risk associated with that shift.

## 2.7 Costs to Provide a New UV Structure

An alternative to retrofitting the existing chlorine contact structure for the location of the UV equipment would be to construct a new stand-alone structure. In our opinion, the capital cost of a new structure would be in the order of $1.1 million.

## 3.0 MECP APPROVAL REQUIREMENTS

The next steps, should the Municipality choose to proceed with converting the current chlorine contact tank into a UV disinfection system would include applying to the MECP for an Amended Environmental Compliance Approval (AECA) for the WPCP.

## 4.0 NEXT STEPS

Should the municipality choose to proceed with the project, the next steps include:
- Approvals;
- Equipment selections;
- Final design;
- Tendering;
- Construction;
- Commissioning.

## 5.0 SUMMARY AND CONCLUSION

Under the Wastewater Systems Effluent Regulations (WSER) SOR/2012-139, for systems that release less than 5,000 $m^3$/day, based on an annual average, the total residual chlorine (TRC) standard (not to exceed 0.02 mg/L), comes into force on January 1, 2021. Two options for addressing this change were evaluated, chlorination/dechlorination and UV disinfection. UV disinfection was considered the preferred approach to reducing/eliminating TRC at the Walkerton WPCP, as the WPCP will not use any chlorine for disinfection with this option, thus reducing the TRC to 0 mg/L.

Ideally construction will occur when the influent flows to the WPCP are lower, during the summer months. During construction, the flow will be diverted through the north chlorine contact tank, which will be decommissioned once the conversion to UV disinfection is complete. To maintain adequate treatment during construction with only one chlorine contact tank online, the maximum flow rate for 30 minutes contact time is 6,100 $m^3$/day, which accounts for 95% of the flows between May and October, based on 2016 and 2017 flows. The maximum flow rate for 15 minutes contact time at peak flows is 12,180 $m^3$/day to maintain adequate treatment.

The capital cost of converting the chlorine contact tank to UV disinfection is estimated to be $626,000. Based on an estimate provided by Trojan for their UV3000plus system, the annual operating costs are expected to be $32,000. This figure includes annual lamp replacement and electricity costs.

Next steps, should the Municipality choose to proceed with the conversion include, applying to the MECP for an AECA, equipment selections, final design, approvals, tender, construction and commissioning.

B. M. ROSS AND ASSOCIATES LIMITED

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