TORONTO

STAFF REPORT
ACTION REQUIRED

Peer Review Findings of the Ashbridges Bay Treatment Plant Effluent Class Environmental Assessment Study

Date:	April 11, 2011
To:	Public Works and Infrastructure Committee
From:	Lou Di Gironimo, General Manager, Toronto Water
Wards:	All Wards
Reference Number:	P:\2011\Cluster B\TW\pw11005

SUMMARY

This report summarizes the results of a peer review conducted on the Ashbridges Bay Treatment Plant Effluent Disinfection Class Environmental Assessment Study Report ("ABTP Disinfection EA Study") prepared by AECOM, dated February 2010. City Council directed staff to peer review the evaluation and scoring methodology used in selecting the preferred option for the EA Study.

The peer review was completed by Associated Engineering and focussed on the development of alternative disinfection strategies, the decision making process and the assigning of weights for costs, green house gas emissions and disinfection by-products. The peer review also updated and verified the various costs and conducted a sensitivity analysis on those costs and the decision making process.

The peer review confirmed that the ABTP Disinfection EA Study correctly selected Alternative 4 (the use of liquid sodium hypochlorite for disinfection and liquid sodium bisulphite for dechlorination of both the secondary and primary effluent streams) as the top ranking disinfection strategy.

A copy of the Executive Summary of the Final Report can be found as Attachment 1 to this report.

RECOMMENDATIONS

The General Manager of Toronto Water recommends that:

1. City Council receive Attachment 1, the Executive Summary of the peer review prepared by Associated Engineering of the Ashbridges Bay Treatment Plant Effluent Disinfection Class Environmental Assessment Study Report; and

2. Direct staff to implement Alternative 4 (the use of liquid sodium hypochlorite for disinfection and liquid sodium bisulphite for dechlorination of both the secondary and primary effluent streams) as identified in the Ashbridges Bay Treatment Plant Effluent Disinfection Class Environmental Assessment Study Report prepared by AECOM, dated February 2010, for the City to meet all current regulations including the Canadian Environmental Protection Act.

DECISION HISTORY

At the August 25, 26 and 27, 2010 meeting, City Council authorized the General Manager of Toronto Water, to engage the professional services of a firm specializing in the Province of Ontario's Municipal Class Environmental Assessment process to undertake a peer review of the option evaluation and scoring methodology used in the selection of the preferred option in the Ashbridges Bay Treatment Plant Effluent Disinfection Class Environmental Assessment Study – February 2010; and report back to the next meeting of the Public Works and Infrastructure Committee in 2011 on the results of the peer review.

http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2010.PW35.13

ISSUE BACKGROUND

The City submitted an Environmental Assessment (EA) for the Ashbridges Bay Treatment Plant (ABTP) to the Ontario Ministry of the Environment (MOE) in 1997. In 1999, the City undertook a self-directed mediation with a number of interested parties in response to a series of concerns raised by various stakeholders. The outcome of the process was the drafting of an Environmental Assessment Mediation Agreement (MA) and the formation of the Implementation and Compliance Monitoring Committee (ICMC).

The City submitted an amended EA and a copy of the MA to the MOE for review in 1999. MOE staff released their review of the EA as amended by the MA in April 2004. The MOE concluded that the EA had satisfied all the requirements of the Environmental Assessment Act and would be recommending approval. Outstanding issues identified by the public, various stakeholders and some member of the ICMC were deemed to be either outside the scope of the EA, were being addressed through other City initiatives, or were

better addressed at the Certificate of Approval stage. The public comment period on the review ended in June 2004.

On January 24, 2008 the City of Toronto received final approval from the MOE for the ABTP EA Undertaking, which included a new outfall pipe, an effluent pumping station and a new ultraviolet (UV) disinfection system.

In 2008, City staff opted to review the various disinfection methods currently available as the EA documents were now over 12 years old and technology, costs and regulations had evolved. As required by both the terms of the Mediation Agreement and MOE's EA approval conditions, the City of Toronto conducted a Schedule B Class Environmental Assessment (EA) study to review the various disinfection methods currently available to determine whether UV disinfection was still the best alternative to treat the effluent and bypass streams from the ABTP. The outcome of the study was intended to help the City achieve the following objectives:

- To provide adequate disinfection of ABTP effluent to meet regulations and criteria set out by the Ontario Ministry of the Environment;
- To improve the Blue Flag beach status in the vicinity of the ABTP;
- To eliminate chlorine residual from the effluent to meet Federal Pollution Prevention regulations under the Canadian Environmental Protection Act; and
- To eliminate reliance on chlorine gas in order to eliminate any real or perceived public health risk associated with use of chlorine rail cars.

The study compared various alternate disinfection strategies against UV disinfection and, in light of the most current information on effectiveness, energy usage, environmental impacts and capital and operating costs, recommended chlorination with sodium hypochlorite and dechlorination with sodium bisulphite for all effluent discharged from ABTP.

A Notice of Completion was published in local newspapers and was distributed to those on the project contact list. The 30-day public review period commenced February 25, 2010 and closed on March 26, 2010. The MOE received four Part II order requests, however these were denied by the Minister and the Schedule B Class EA for disinfection was approved by the MOE on August 13, 2010.

COMMENTS

Associated Engineering (AE) was retained by the City to undertake a peer review of the Ashbridges Bay Treatment Plant Effluent Disinfection Environmental Assessment Study (ABTP Disinfection EA Study). A complete copy of the Final Report and Appendices can be obtained at the following link:

http://www.toronto.ca/water/wastewater_treatment/treatment_plants/ashbridges/pdf/**rpt_abtp_peer_review.pdf**

The scope of the undertaking was to review, verify and comment on whether the analysis adequately assessed the various alternatives, verify the capital, operation and maintenance costs, and confirm that the weighting criteria properly reflected the environmental risks associated with the disinfection by-products and the estimated green house gas emissions for each of the disinfection alternatives.

Disinfection is the final stage of wastewater treatment and its purpose is to protect human health by destroying or inactivating pathogenic organisms in the water prior to it being discharged back into the environment. As part of the ABTP Disinfection EA Study, four alternatives were selected for detailed evaluation of possible options for effluent disinfection at Ashbridges Bay Treatment Plant:

- *Alternative 1:* UV disinfection of secondary effluent and primary effluent bypass
- *Alternative 2:* UV disinfection for secondary effluent and chlorination/dechlorination for primary effluent bypass
- *Alternative 3:* Ozonation of secondary effluent and primary effluent bypass
- *Alternative 4:* Chlorination/dechlorination for secondary effluent and primary effluent bypass

After a detailed evaluation taking into account the environmental, social and cost impacts for each alternative, Alternative 4, chlorination/dechlorination for both the secondary and primary effluent streams emerged as the preferred option.

Alternative 3 was not assessed in the peer review since it scored significantly lower than the other alternatives in the ABTP Disinfection EA Study. Also, it was confirmed to be the most costly alternative to implement.

Key Findings

1. Cost

Overall, the review team determined that the costs used in the ABTP Disinfection EA Study were sound. Nevertheless, to better capture and compare costs based on the years in which the expenditures are to be incurred, the review team recalculated the capital and operational and maintenance (O&M) costs using 2014 dollars – which is expected to be the mid-point of construction. This resulted in an increase of the life cycle cost of 23%, 15% and 12% for Alternatives 1, 2 and 4 respectively.

In addition, updated chemical and labour costs also modified the O&M costs, as an increase in electricity costs and lower chemical costs made Alternative 4 more favourable over Alternative 2.

Beyond the twenty year life cycle of the various disinfection alternatives, it was found the relative simplicity of the chlorination/dechlorination process allows for an extension of the facility's useful life past the twenty year point with only modest refurbishment costs.

The concrete contact tanks used in the chlorination/dechlorination system also allows for future adaptability should alternative disinfection chemicals become preferred.

A UV disinfection system has much more mechanical, electrical and control equipment associated with it and the required cost to refurbish the facility after twenty years would be significantly higher than for Alternative 4. Reuse of the UV building and channels are also considered to be less flexible for use with alternative disinfection technologies.

Opportunities to optimize the design of Alternative 4 were identified by the peer review consultant. Certain modifications to the proposed design concept could reduce if not eliminate the need for some large concrete (chlorine contact) tanks. The corresponding cost savings could be significant and would help offset the cost of the new outfall.

2. Environmental Factors

Green house Gas Emissions

The review of the green house gas (GHG) emissions for the disinfection alternatives suggested that the analysis and approach used was in accordance with current industry practices. The review team felt the GHG gas emission factor for sodium hypochlorite production should be higher than used in the Class EA Disinfection Study – however the change does not impact the relative ranking of the alternatives nor the conclusion that Alternative 4 generates the least quantity of GHG. The weighting of the GHG emission criterion within the six environmental criteria was awarded 24 percent of the available environmental weight points which the review team felt was appropriate given the City's objective to reduce GHG emissions.

Disinfection by-products

The Ontario Ministry of Environment and the United States Environmental Protection Agency recognize that properly conducted dechlorination is sufficient to minimize the toxic effects to aquatic organisms of the disinfection by-products of chlorination. The peer review found that the weighting of the disinfection by-product criterion was suitable with 12 percent of the available environmental weight points being allocated.

3. Evaluation Model

The multi-criteria analysis tool, commonly referred to as the Triple Bottom Line (TBL) approach, was found to be appropriate and commonly used in environmental assessments of this nature. Under the TBL evaluation scoring approach, Alternative 4 remains the highest scoring option regardless of changes in the weightings.

A sensitivity analysis was undertaken on the model to determine whether the outcome would be affected if the scores were changed to more heavily favour one alternative over another. The relative position of the three alternatives remained unchanged in ranking. The results of this analysis supports the conclusion that Alternative 4 is the highest rated alternative based on the decision making process used.

The design of a new disinfection system at the ABTP may require construction of an effluent pumping station. The capital and O&M cost of such a pumping station would be

significant and requires valuable plant property. The peer review team agreed that a pumping station will be necessary for Alternative 1 and 2, but may not be necessary for Alternative 4. As such, the cost analysis includes both scenarios – identified in the report as 'maximum pumping" and "minimum pumping."

The table below summarizes and provides a comparison of the disinfection alternatives reviewed in this report:

Comparison of Alternative Disinfection Strategies

	Alternative 1 ***UV disinfection for secondary effluent and primary effluent bypass***	**Alternative 2** ***UV disinfection for secondary effluent and chlorination/ dechlorination for primary effluent bypass***	**Alternative 4** ***Chlorination/ dechlorination for secondary effluent and primary effluent bypass***
Secondary effluent disinfection	UV	UV	Sodium hypochlorite/ sodium bisulphite
Primary effluent bypass disinfection	UV	Sodium hypochlorite/ sodium bisulphite	Sodium hypochlorite/ sodium bisulphite
Green house Gas Emissions [1]	3786 kg CO_2 e/d	3794 CO_2 e/d	1846 CO_2 e/d
Energy demand [2]	6.6 MW	2.9 MW	0.3 MW
Increase in total ABTP energy demand [3]	45%	20%	2%
Capital Cost, 2014 dollars, (minimum pumping)	$290,000,000	$183,000,000	$134,100,000
Capital Cost, 2014 dollars, (maximum pumping)	$290,000,000	$201,000,000	$169,000,000
First Year (2015) O&M Cost (Cash Flow dollars)	$2,350,000	$2,160,000	$1,720,000
20 year Life Cycle Cost (NPV 2011 dollars, maximum pumping requirement) [4]	$297,100,000	$213,300,000	$179,100,000.

Notes:

1. Based on rated average day flow (818 ML/d) operation for secondary effluent disinfection system and average annual primary effluent bypass volume of 6 ML/d (calculated based on historical flow data from 2000 – 2008).
2. Based on peak disinfection process energy demand and minimum required pumping for each Alternative (4,000 ML/d for Alternative 1, 2,000 ML/d for Alternative 2 and 0 ML/d for Alternative 4)
3. Based on existing plant energy demand of 14.7 MW
4. Based on 3% inflation and 5% interest rates

Based on 2014 as the mid-point of construction, there is a $48,900,000 capital cost savings when choosing Alternative 4 over Alternative 2 under the “minimum pumping” scenario; and a $32,000,000 capital cost savings under the “maximum pumping” scenario. The savings realized can be directed towards other capital projects at the ABTP such as construction of the new outfall.

With the finalization of the preferred disinfection alternative, staff can move forward with releasing a Request for Proposal for the design and construction of the preferred disinfection system and outfall pipes.

CONTACT

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ATTACHMENTS

Attachment 1: Executive Summary of Ashbridges Bay Treatment Plant Effluent Disinfection Class EA Study Peer Review Report