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RWSC 2012 - 11

REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY, SEPTEMBER 5, 2012

SUBJECT **JAPAN GULCH CHLORAMINATION PROCESS UPGRADE**

ISSUE

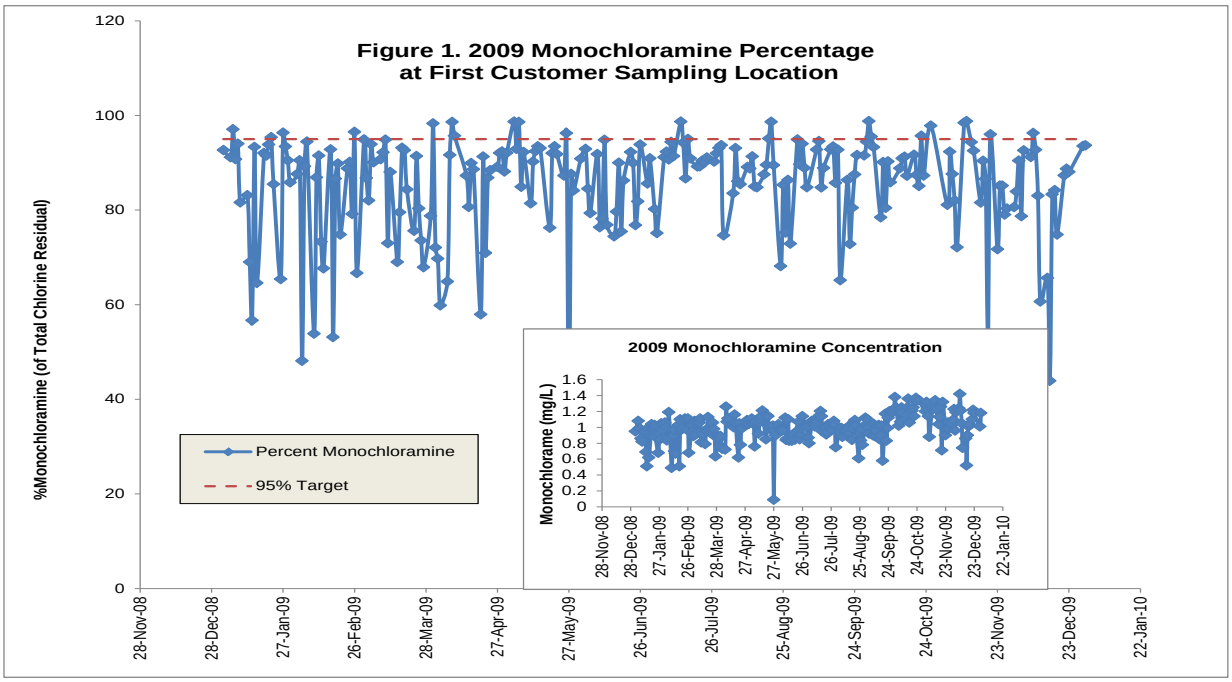
An upgrade is required to the chloramination process at the Japan Gulch Disinfection Plant to eliminate the danger of chlorine and ammonia gas leaks and to provide more consistent addition of ammonia into the drinking water supply.

BACKGROUND

Water from Sooke Lake Reservoir is disinfected at the Japan Gulch Disinfection Plant using ultraviolet light followed by the addition of chlorine and then ammonia. In the water, these latter two substances combine to produce chloramines. Chloramines have the advantage of being very long lasting (i.e. a residual amount of chlorine provides continuing disinfection even out to the extremities of the distribution system), lower production of disinfection byproducts such as trihalomethanes and haloacetic acids and lower perception of chlorinous tastes and odours.

Currently, large, 1-tonne chlorine and ammonia gas cylinders are trucked from a supplier in Vancouver to the Japan Gulch Disinfection Plant after being transported on a special, dangerous goods ferry. Once connected there are safety measures in place to minimize the risk of chlorine gas escaping the building (automatic cylinder shut-off valves and a 'scrubber' system to neutralize the chlorine in the event of a gas leak). Staff are also trained in dealing with leaks however, there remains the risk with transportation and handling of the chlorine and ammonia cylinders. Due to increasing concerns about the risks of transporting and using chlorine and ammonia gas, a number of water utilities across North America have switched to less hazardous ways of using these chemicals, either by using lower concentration liquids or on-site generation of chlorine. Along with these concerns, the existing chlorination and ammonia dosing infrastructure has been in use for 30 years. Although there have been minor upgrades to equipment related to the process over the years, much of the equipment is near or at the end of its service life, impacting maintenance costs and availability of replacement parts.

In addition, there have been historical problems in maintaining consistent concentrations of chloramines in the distribution system (**Figure 1** provides data from 2009).



The consultant and staff believe that these problems occur due to the significant lag time that exists between (a) determining the required dosage (based on a calculation using instantaneous flow rate at the treatment plant), and (b) delivering the ammonia at the existing dosing locations 0.4 km to 0.5 km away from the plant. This lag time has led to inconsistent chloramine levels overall and varying amounts of chloramine components (chloramines include mono-chloramine which is desirable and di-chloramine which is less desirable).

To resolve the safety and chemical dosing issues, a consultant (AECOM) was retained to review the existing chlorine and ammonia infrastructure at the Japan Gulch Disinfection Plant and consider alternative methods for chloramination. The options and life-cycle costs considered by the consultant are outlined in Table 1:

Table 1 – Estimated Life–Cycle Costs for the Disinfection Options

Description	Option 1 – Bulk Gas	Option 2 – Bulk 12% Hypochlorite	Option 3 – On-site 0.8% Hypochlorite Generation	Option 4 – On-site 12% Hypochlorite Generation	Option 5 – On-site Gas Generation
Capital Cost	$ 2,310,000	$ 2,640,000	$ 5,770,000	$ 7,640,000	$ 8,410,000
25 Year NPV of Operating Cost	$ 5,710,000	$ 7,220,000	$ 8,160,000	$ 8,430,000	$ 8,980,000
Total 25 Life Cycle Cost	**$ 8,020,000**	**$ 9,860,000**	**$13,930,000**	**$16,070,000**	**$17,390,000**

Option 1 Bulk delivery of chlorine gas
Option 2 Bulk delivery of 12-15% sodium hypochlorite
Option 3 On-site generation of 0.8% sodium hypochlorite
Option 4 On-site generation of 12-15% sodium hypochlorite
Option 5 On-site generation of chlorine gas

To assist with determining a recommended option, the consultant prepared a decision matrix. Nine economic, social and environmental factors were considered in the matrix for each option, including life-cycle costs, to determine the option with the highest cost-to-benefit ratio, which was Option 2.

The consultant's recommendations, which are endorsed by staff, include the following:

- Change from using gaseous chlorine to using 12 – 15% sodium hypochlorite (Option 2 and hereafter referred to as 'liquid chlorine') delivered by truck and construct a new liquid chlorine storage and dosing facility at the Japan Gulch Disinfection Plant.

- Change from using gaseous ammonia to using aqueous ammonia (hereafter referred to as 'liquid ammonia') delivered by truck and construct a new liquid ammonia storage and dosing facility in the pipe yard below the Japan Gulch Disinfection Plant and just inside the Goldstream Gate.

Note: full copies of the consultant's report are available on request.

Since the addition of liquid chlorine and liquid ammonia are two distinct disinfection steps that are separated in time (ammonia is added more than 10 minutes downstream of the chlorine addition) and location, it is proposed that the upgrade to the Japan Gulch Disinfection Plant chloramination process be phased as follows:

- 2013 – Prepare detailed design of the liquid chlorine and liquid ammonia storage and dosing facilities and tender construction.
- 2014 – Construct the liquid ammonia storage and dosing facility.
- 2015 – Construct the liquid chlorine storage and dosing facility.

ALTERNATIVES

Alternative 1. That the Regional Water Supply Commission approve the recommendation to upgrade the chloramination process to liquid chlorine and liquid ammonia, and include the funding in the 2013-2015 Capital Budgets, for further review by the Regional Water Supply Commission Budget Subcommittee in October 2012.

Alternative 2. That the Regional Water Supply Commission approve no change to the current chloramination system.

FINANCIAL IMPLICATIONS

A budget estimate of $5.5 million has been established for this project. This budget figure includes the consultant's estimates for design, construction, construction contingency, and the CRD's allowance for CRD project administration and overall project contingency. Capital funding requirements over the 3 years are estimated to be as follows:

2013: $0.5 million to design and tender the new liquid chlorine and liquid ammonia storage and dosing facilities.
2014: $2.5 million for the construction of the new liquid ammonia storage and dosing facility.
2015: $2.5 million for the construction of the new liquid chlorine storage and dosing facility.

The capital budget figures will be adjusted over the three year duration of the project as actual costs are determined through tendering and completion of the various phases.

CONCLUSION

To address increasing concerns about the use of gaseous chlorine and ammonia at the Japan Gulch Disinfection Plant, it is necessary to consider alternative chloramination methods that involve less handling risks. Historical difficulties in maintaining stable chloramine levels in the distribution system would also be addressed by the recommended chloramination upgrades.

RECOMMENDATION

That the Regional Water Supply Commission approve the recommendation to upgrade the chloramination process to liquid chlorine and liquid ammonia, and include the funding in the 2013-2015 Capital Budgets, for further review by the Regional Water Supply Commission Budget Subcommittee in October 2012.

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