

CHLORAMINATION PILOT STUDY TOWN OF GANDER

Presented by: Tracey Eisan, B.Sc.Eng.

DMG Consulting Ltd.

tracey.eisan@dmg.nf.ca

Clean and Safe Drinking Water Conference

March 22-24, 2016

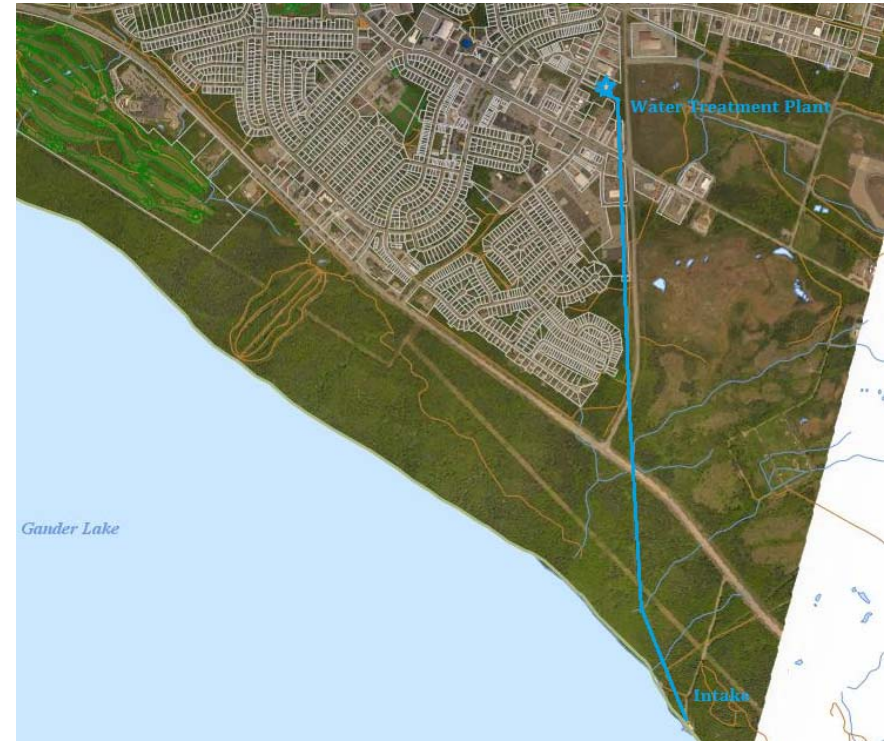


THE GANDER DRINKING WATER SYSTEM



WATER SOURCE: GANDER LAKE

- Third largest lake in Newfoundland: Surface Area = 113.2 km²
- Approximate Volume = 3.0 trillion USG
- Intake at lake pumps directly to the Water Treatment Plant
- High levels of **colour** and **natural organic matter**



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THE GANDER DRINKING WATER SYSTEM



WATER TREATMENT PLANT

- Commissioned in 2007
- Primary Treatment: **Ozonation and Filtration**
- Secondary Treatment: **Chlorination**
- Services a population of approx. 13,000 (including the Airport and Canadian Forces Base Gander).



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THE GANDER DRINKING WATER SYSTEM



PROBLEM

- Study completed in 2014 determined the following:
 - Low chlorine residuals in the extents of Town
 - High levels of Disinfection By-Products (HAAs/THMs) caused by high levels of NOM

POTENTIAL SOLUTIONS

Chlorine Booster Station:

- \$\$\$
- Could increase DBP formation (reaction of chlorine with natural organic matter)

DAF Filtration System

- \$\$\$
- Would not improve chlorine residuals

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CHLORAMINES AS A DISINFECTANT?



- Formed by the reaction of ammonia with chlorine
- Can be used as an alternative to chlorine for secondary disinfection
- Chloramines are **more stable** than chlorine; maintain a disinfection residual further into the distribution system
- Do not react with NOM the same as chlorine; lowers formation of DBPs.
- Currently used in over **100** Canadian municipalities, including St. John's, Ottawa and Toronto.

NOTE: The Gander WTP was originally designed to use chloramines as a secondary disinfectant.

Already includes separate injection room and injection points into the main water line.

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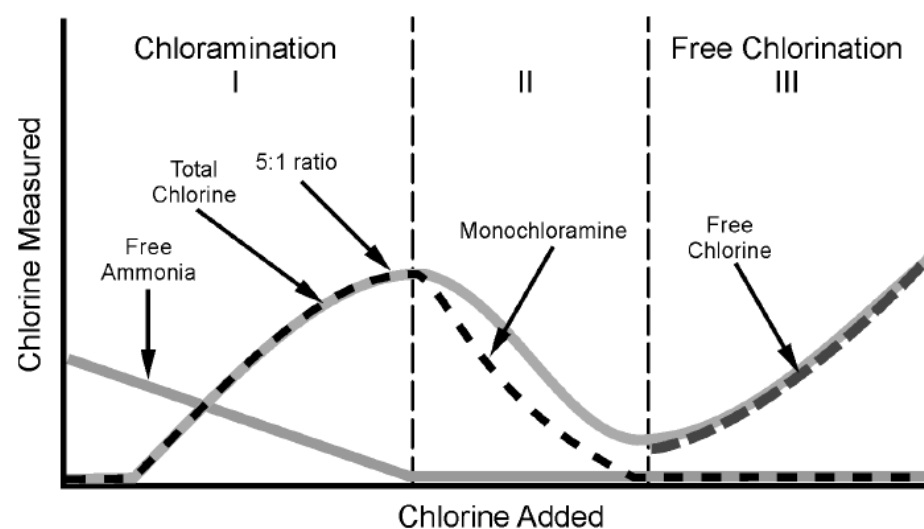
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CHLORAMINES AS A DISINFECTANT?



- Three compounds can be formed:
Monochloramine, Dichloramine, Trichloramine
- **Monochloramine** is the preferred disinfectant. This is achieved by an optimal reaction of chlorine and free ammonia. (Generally a 5:1 ratio)
- **Di – And Tri- Chloramines** are formed by excess chlorine. This can lead to taste/odor issues, and increased operational expenses.



Source: Hach (2015)

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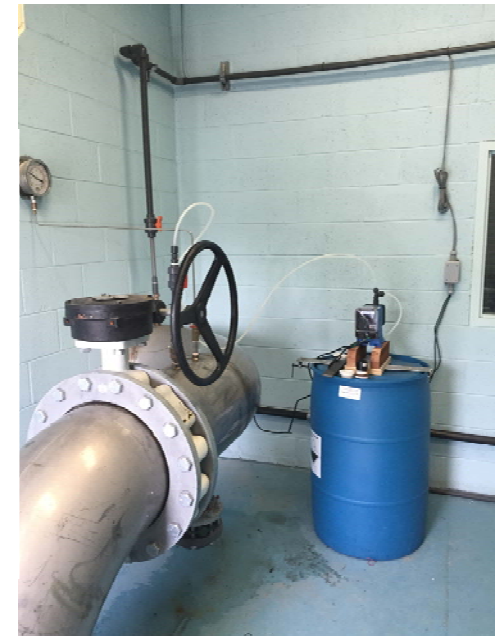


FLOW PROPORTIONAL SYSTEM:

- King Process Technology Inc. developed liquid ammonia injection system
- Able to test the effectiveness of chloramines on the system
- Flow proportional – ensured accurate results

LENGTH OF PILOT STUDY:

- Study commenced on August 4, 2015
- Carried out for twelve (12) weeks



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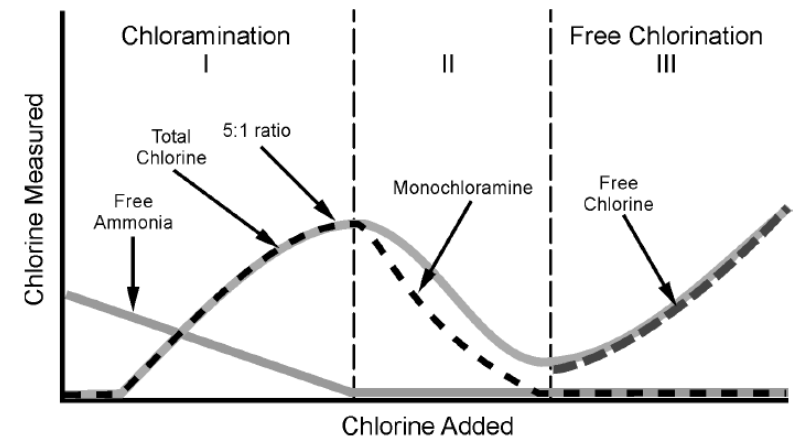
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THE CHLORAMINATION PILOT STUDY



TESTING PARAMETERS:

- Four (4) parameters monitored for chloramination
 - **Monochloramine** - Primary measurement for disinfection
 - **Free Ammonia** - Excess ammonia remaining after formation of monochloramines
 - **Free Chlorine** - Excess chlorine remaining after formation of monochloramines
 - **Total Chlorine** - Sum of **free chlorine** and **chloramine** compounds (mono, di- & tri)



Source: Hach (2015)

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TESTING PARAMETERS

- Water quality parameters for safety:
 - E. Coli, Total Coliforms
 - HAAs, THMs
 - NDMA (a potential bi-product of chloramination)

TESTING PARAMETER	TESTING FREQUENCY
Free Chlorine, Total Chlorine Monochloramine, Free Ammonia	Daily
E.Coli, Total Coliforms HAAs and THMs	Weekly
NDMA	Twice During Study (Beginning and Middle)

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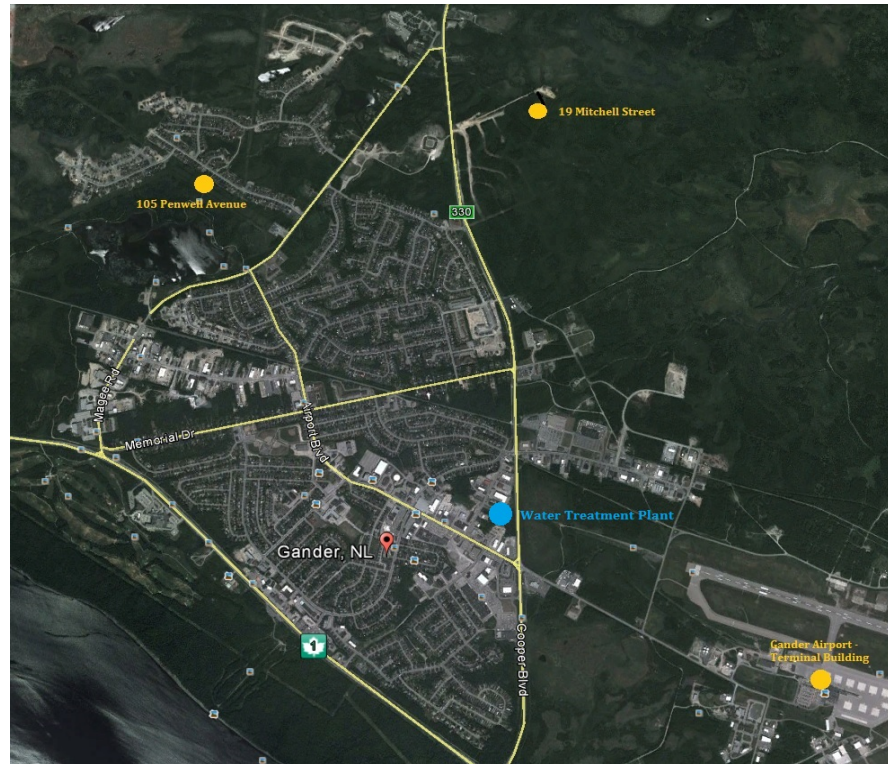
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TESTING LOCATIONS

- Mitchell Street
- Penwell Avenue
- Gander International Airport



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RESULTS AND FINDINGS



Disinfection Residuals (Monochloramine):

- Achieved at all test locations (Averages ranged from 0.36 mg/L to 1.27 mg/L)
- Took a period of 2-3 weeks for results to stabilize (trial and error at WTP)
- Airport had higher residuals due to proximity to WTP and continuous line flushing

Guideline: > 0.03 mg/L

Free Ammonia and Chlorine

- Averaged between 0.07 mg/L and 0.3 mg/L Preferred: 0.0 mg/L
- Would be easier to optimize with gas chloramination feed rate control and operator familiarity.

Taste/Odor

- A few complaints over first 2 weeks of study; none after.

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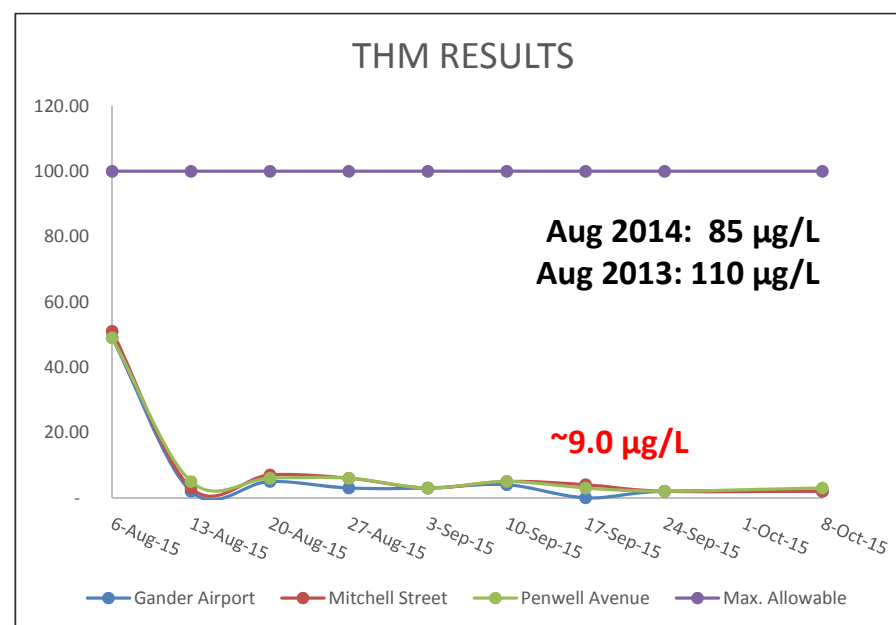
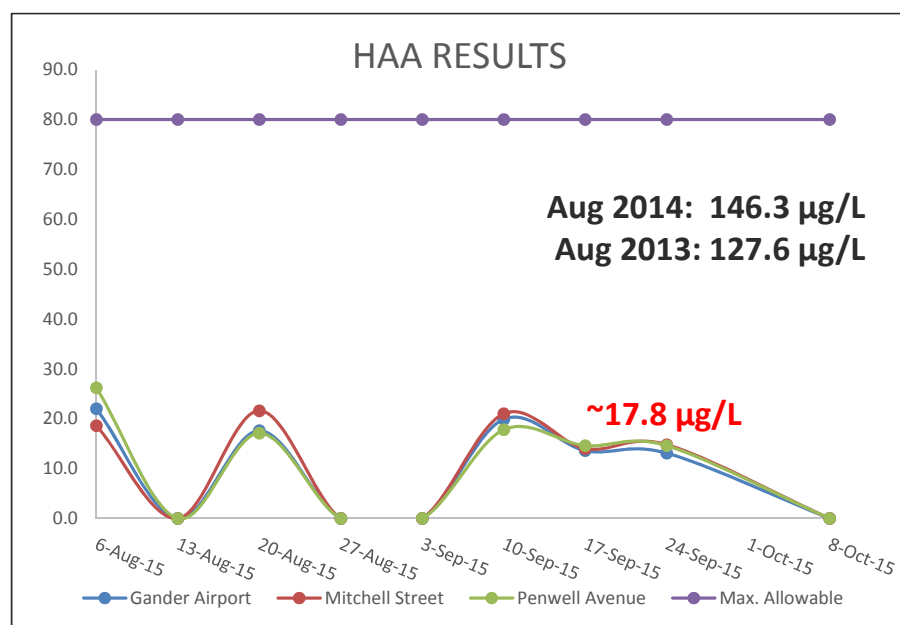
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RESULTS AND FINDINGS



HAAs/THMs



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RESULTS AND FINDINGS



E. Coli, Total Coliforms, NDMA

- All within Canadian Drinking Water guidelines

Operational Requirements

- Increased labour required during pilot study (daily testing, switching liquid ammonia drums)
- **No flushings** required – prior to study was common occurrence in dead ends
- Permanent gas chloramination system would be less labour intensive

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CONCLUSIONS AND CONSIDERATIONS



- Chloramines successful with increasing disinfection residuals and lowering DBPs
- Can be looked at as an alternative to other **costly** systems
- Does **not** solve issue of organics in water; Biofilm still an issue and needs to be controlled
- Pilot study ideal to test chloramines on a system without committing to new treatment system
- Additional labour required during a pilot study, however lessens with a permanent system
- Depending on layout of existing facility, may require modifications
- **Not compatible with amphibious animals (fish, reptiles, etc) or kidney dialysis patients.**

PUBLIC NEEDS TO BE INFORMED

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QUESTIONS?



Tracey Eisan, B.Sc.Eng.

DMG Consulting Ltd.

185 Roe Avenue, P.O. Box 194

Ph: 709-256-7501

tracey.eisan@dmg.nf.ca

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