

# An assessment of public indoor swimming pool air quality from the perspective of an employee

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## Background

- The Health Protection and Promotion Act Regulation 565 (1990) requires public pool water to be treated with chlorine or a chlorine/bromine compound. When chlorine is added to water, it forms hypochlorous acid (HOCl) and hydrochloric acid (HCl) (Luttrell et al, 2008)
- HCl is known to be a pulmonary irritant thus stimulating receptors and inducing inflammation (Luttrell et al, 2008)
- Chloramines result when HOCl reacts with nitrogen containing compounds (i.e. sweat and urine) in water (Florentin et al, 2011)
- A number of studies have shown a relationship between trichloramine and an increase in the prevalence of irritation and other respiratory symptoms (Massin et al, 1998; Hery et al, 1995; Jacobs et al, 2007)

**Objective:** This exploratory study was aimed at surveying Class A pools to determine employees perceptions of indoor air quality while concurrently taking quantitative measurements of three common disinfection byproducts

## Methodology

- Six indoor pool sites in a municipality in the Greater Toronto Area were surveyed
- At each site, employees over the age of 18 were asked to complete a survey consisting of questions regarding demographic information, their subjective perception of the indoor air quality and related health effects
- Simultaneously, the airborne concentration of chlorine, hydrogen chloride and trichloramine was determined using active air sampling and their related sampling methods (Table 1)
- Two area samples were taken for each chemical at two different locations at each pool site
- Samplers were attached to lifeguard chairs 6 feet above pool deck
- Procedure was repeated at each of the six sites

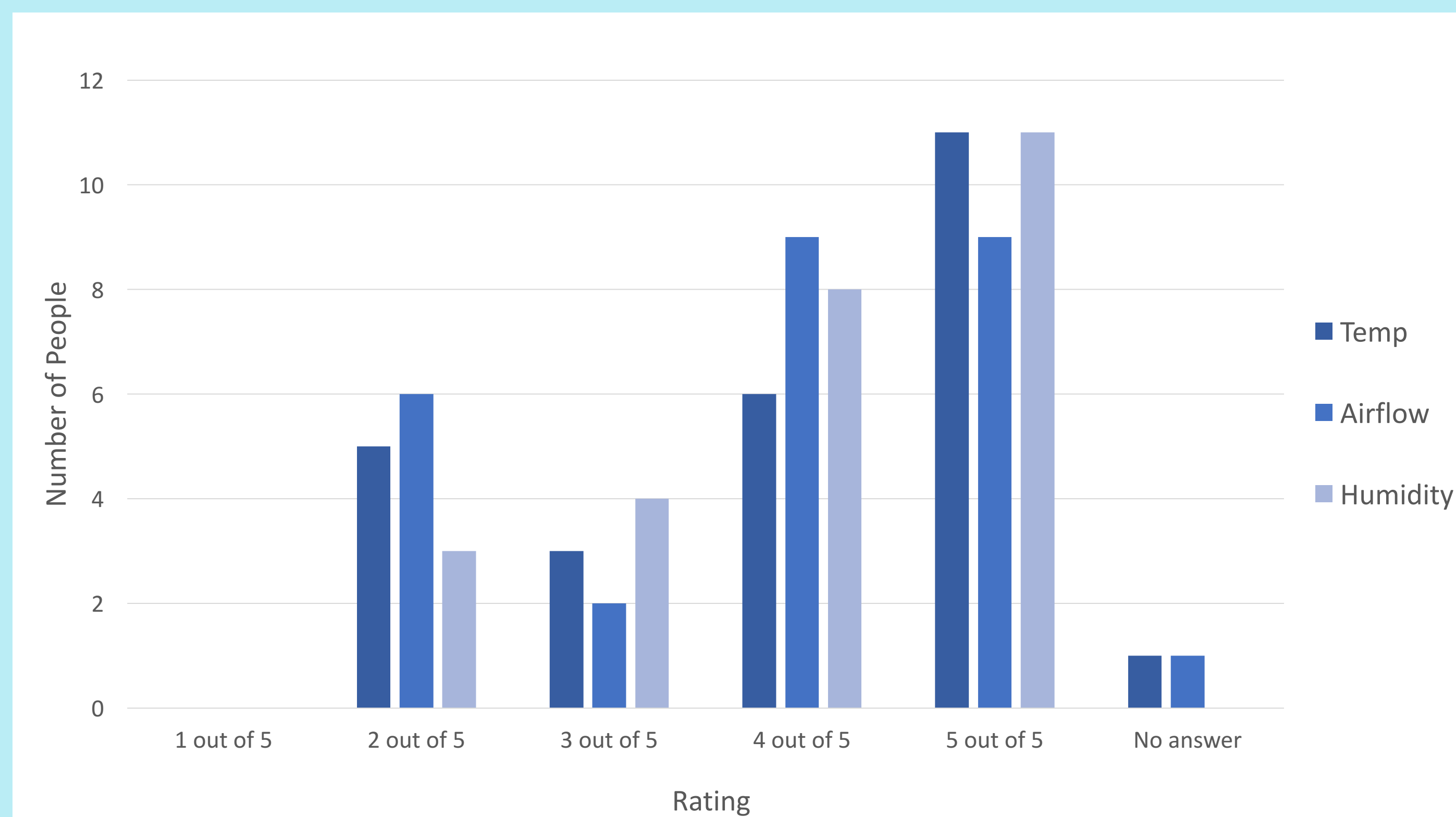
**Table 1.** Specificities of sampling method used for each chemical sampled

Chemical	Sampling Method	Media	Flow Rate (L/min)	LOD (µg)
Chlorine	NIOSH 6011	PTFE, 0.5 µm + silver membrane, 22mm, 0.45 µm	1.0	0.6
Hydrogen Chloride	OSHA ID-174-SG	Silica gel	0.5	0.6
Trichloramine	Hery Method (Hery et al, 1995)	Teflon filter, cellulose pad and soaked quartz fibre filter	1.0	122.3

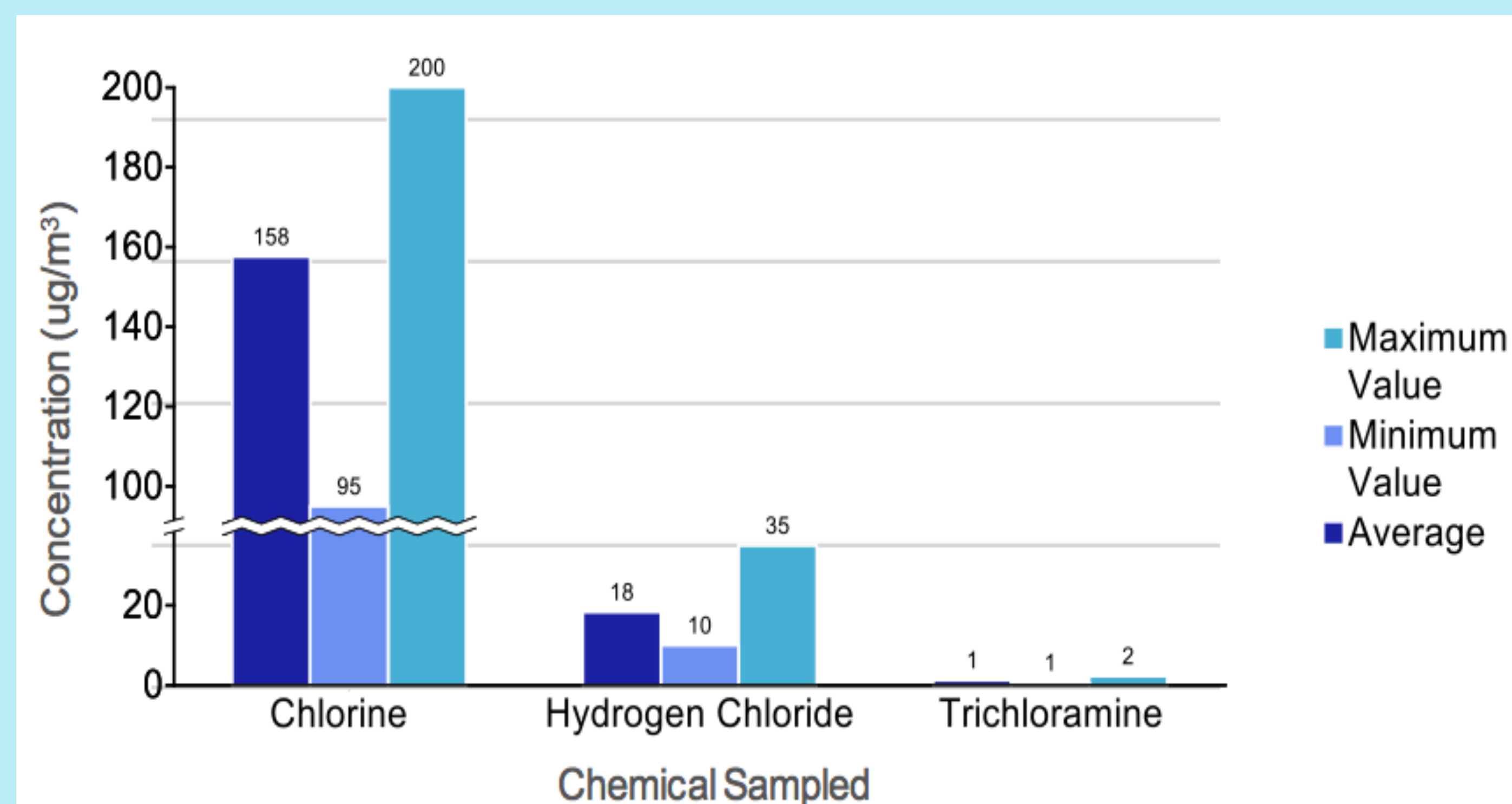
## Results

**Table 2.** Breakdown of demographic data of individuals who took part in the questionnaire (n=26)

Gender	
Male	20
Female	6
Age	
18-24	14
25 or older	11
No answer	1
Years working at current location	
Less than 1	4
1-5 years	17
6 years or more	5
Hours worked per week	
Less than 12	11
12-19	8
20 or more	7



**Figure 1.** Employees responses regarding temperature, air quality and humidity on a day to day basis (n= 26). Each parameter was rated on a scale between 1-5



**Figure 2.** Average measured concentrations of chlorine, hydrogen chloride and trichloramine across the six pool sites surveyed

## Discussion

- Studies have indicated that trichloramine concentrations ranging from 0.1-0.57 mg/m<sup>3</sup> have resulted in an increase in respiratory effects (Hery et al, 1995; Jacobs et al, 2007)
- Compared to other studies, the measured airborne concentration of trichloramine obtained in this study is significantly lower
- While there was a substantial amount of airborne chlorine, it does not seem to be a concern to employees
- A limitation exists in the fact that measurements were taken on a single day for a 90 minute time period, because of this, exposure was assumed to be consistent

## Recommendations

Moving forward, the following factors should be investigated:

- Generation of a larger sample size** – Include employees who are under the age of 18
- More sites** – In the same municipality or in different municipalities to determine if there is consistency in results
- Varying time period** – Different times of day or different time of the year

## Conclusion

- The results show that the control measures currently in place are effective in maintaining airborne disinfection byproducts at a low level
- Also, supports the fact that pool sites are following correct protocol when it comes to bather hygiene and site maintenance

## References

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*Public Pool Regulations*, Health Protection and Promotion Act Reg. 565/1990

## Acknowledgements

A special thanks the Lifesaving Society and the City of Markham for their support on this project

