



Bruderheim Volatile Organic Compounds Speciation Study Report Summary: October 7, 2021

Background

One of Fort Air Partnership's (FAP's) monitoring objectives is to characterize emerging issues and sources affecting air quality in its Airshed, which encompasses the Industrial Heartland and surrounding region. Questions have arisen in recent years from residents in and around the Town of Bruderheim regarding odours and possible volatile organic compound emissions from oil and gas installations in the area.

Hydrocarbons are substances consisting of hydrogen and carbon. Volatile Organic Compounds (VOCs) are a type of hydrocarbon, also referred to as non-methane hydrocarbons (NMHCs), or reactive hydrocarbons.¹ VOCs are organic chemical compounds whose composition makes it possible for them to evaporate under normal atmospheric conditions of temperature and pressure.² Anthropogenic (man-made) sources of VOCs include vehicle emissions, leaks and spillage at gasoline stations and storage tanks, petroleum and chemical industries, dry cleaning, fireplaces, natural gas combustion and aircraft traffic. VOCs are also emitted by "fugitive sources" such as evaporation of solvents, or leaks at industrial facilities, as well as incinerator or flare stacks. Natural sources of VOCs include wildfire smoke and vegetation.³

The Government of Alberta has developed [Alberta Ambient Air Quality Objectives](#) (AAQOs) for several specific VOCs. Since the Bruderheim station began monitoring in 2010, a number of unexplained elevated readings were recorded by the continuous NMHC analyzer at the station. These readings, as well as a recommendation for VOC Speciation monitoring from a network assessment completed for the FAP network in 2012, led to the initiation of this project.

VOC Speciation Monitoring Project Results

The project was conducted in two separate phases (Phase 1 ran from October 2014 to March 2015 and Phase 2 ran from July 2017 to July 2018). All samples were sent to a third-party laboratory for analysis. Due to a change in land use, the Bruderheim station was moved to a new location 700 meters north of the initial site in the winter of 2016. Elevated concentrations of NMHCs continued to be observed at this new site.

¹ <https://www.fortair.org/wp-content/uploads/2020/03/What-We-Monitor.pdf>

² <https://www.epa.gov/indoor-air-quality-iaq/technical-overview-volatile-organic-compounds>

³ <https://www.fortair.org/wp-content/uploads/2019/12/How-Air-Quality-is-Monitored-2019.pdf>

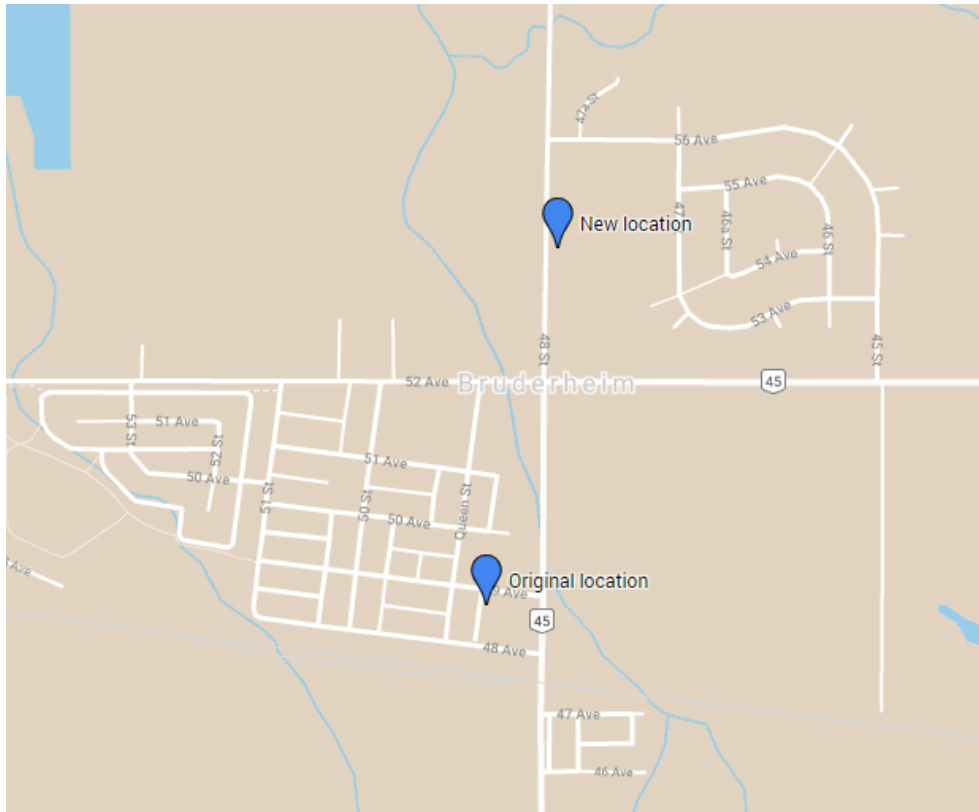


Figure 1: Locations of old and current Bruderheim monitoring station

The speciation project consisted of 24-hour samples being collected every six days. In addition to this, 1-hour samples were collected each time a pre-set level for total NMHCs was reached. This level was set based on concentrations recorded during previous unexplained NMHC events at the Bruderheim station. While the 24-hour samples provided information on the general concentration of VOCs at the site, the 1-hour samples defined the composition of VOCs when NMHC concentrations were elevated.

Almost all 24-hour samples had increased concentrations of pentane, butane, propylene, n-hexane and methylcyclohexane. These VOCs have in previous North American studies been associated with gas or vapor emissions from pressurized equipment due to leaks and other unintended or irregular releases from the production and storage of petroleum-based products.

In addition to this general observation, a few samples contained complex mixtures of VOCs or at times very few VOCs. The observed variability in the 1-hour integrated event samples supports multiple possible source types. The Bruderheim station is located in an area with various sources that are known to emit hydrocarbons into the atmosphere.

The recorded VOC concentrations were also compared to AAAQOs for selected VOC species that have objectives in place. Concentrations measured in this study did not exceed established AAAQOs. Where available and in the absence of AAAQOs, measured concentrations were compared to [Texas Air Monitoring Comparison Values](#) (AMCVs), which are the AAAQO equivalent developed by Texas. VOCs measured during the study did not exceed the short and long term published AMCVs.

Conclusion

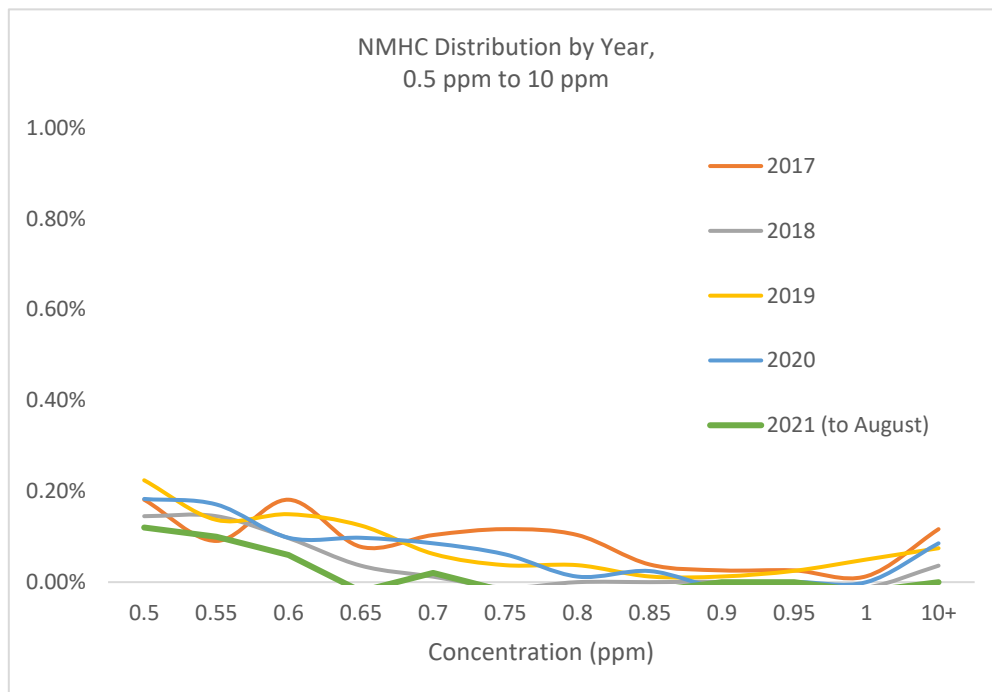
While the study results indicate multiple possible source types, and the Bruderheim station is located in an area with various sources that are known to emit hydrocarbons into the atmosphere, VOCs measured during the study did not exceed established AAAQOs, nor AMCVs. NMHC concentrations at the Bruderheim 1 station continue to be measured to evaluate trends.

Read the full report, posted on FAP’s website.

Update on NMHC monitoring results from 2017 to 2021

An analysis of data collected at the Bruderheim station from January 2017 to August 2021 shows no discernable trend in NMHC measurements over the past five years, either up or down.

All 1-hour average measurements recorded each year were grouped into 0.05 ppm concentration ranges (0.5 to 0.55 ppm, 0.55 to 0.6 ppm etc.) The following plot shows that the number of 1-hour average measurements in each of the categories ranging from 0.5 to 10 ppm was never above 0.2% of the total number of measurements. There were approximately 8,000 individual 1-hour measurements recorded each year, of these 9, 3, 6, 7 and 0 measurements were over 10 ppm during 2017 to 2021 respectively. This means that over the past five years, 99.95% of the measurements taken were under 10 ppm.



The following plot summarizes the annual averages for NMHC measurements throughout the FAP network from 2017-2020. All stations including Bruderheim have an annual NMHC concentration under 0.1 ppm.

