

Project Status Report

Volatile Organic Compound Measurements near Alpine Cabinet Company, Timnath, CO

Prof. Jeffrey L. Collett, Jr., PI (collett@atmos.colostate.edu)

Dr. Arsineh Hecobian, co-PI (arsineh@colostate.edu)

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A team of scientists and students collected whole air samples in evacuated stainless steel canister from locations downwind and upwind of the Alpine Cabinet Company during periods of high odor (as communicated to CSU staff by the Town of Timnath) to measure concentrations of volatile organic compounds (VOCs). Fig. 1 is a map of the locations and dates of the measurements discussed here.



Figure 1. Locations and dates of measurement sites downwind and upwind of the Alpine Cabinet Company.

At each site, two previously cleaned and evacuated canisters were used to collect whole air samples downwind of the company location and one canister was collected upwind to assess background concentrations. After sample collection, canisters were brought to our laboratories at CSU's Atmospheric Science Department to measure the concentrations of 58 VOCs using a multi-channel Gas Chromatograph with Flame Ionization and Mass Spectrometer detection (GC-FID-MS). The concentrations of VOCs in upwind canisters were subtracted from those in the downwind canisters to determine the increase in VOC concentrations due to emissions from the Alpine Cabinet Company operations. Hourly wind direction and wind speed data for the time of measurements were downloaded from Weather Underground's Timnath Ranch station (KCOTIMNA3). After the application of quality assurance procedures for the measurements, one canister from each sample collection event was chosen (based on better downwind location) to assess elevated VOC concentrations. Increased concentrations of seven VOCs from all canisters collected were observed. They are listed in Table 1.

Date and Time	Toluene (ppbv)	Ethylbenzene (ppbv)	m+p-Xylenes (ppbv)	o-Xylene (ppbv)	Acetone (ppbv)	Isopropanol (ppbv)	Methyl Ethyl Ketone (MEK) (ppbv)
3/10/16 10:41	0.25	0.65	2.85	1.01	24.4	59.7	0.86
3/17/16 15:29	0.13	2.30	10.4	3.11	28.7	38.5	0.34
3/31/16 11:21	2.71	6.96	31.2	9.06	38.4	89.3	0.94
4/26/16 9:39	0.02	0.83	3.21	1.08	98.7	10.7	0.04

Table 1: Sampling dates and elevated concentrations of VOCs. All values are reported in parts per billion (ppb) elevated above background.

A comparison of the range of VOCs measured during this project, governmental threshold values, and typical ranges of concentrations reported in peer reviewed publications are presented in Table 2. References for publications can be found at the end of the report. Governmental thresholds are reported for 8 hour Time Weighted Averages (TWA) from Occupational Safety and Health Administrations (OSHA), National Institute for Occupational Safety and Health (NIOSH), and Association Advancing Occupational and Environmental Health (ACGIH). Acetone and isopropanol had the largest increases above background relative to published values of ambient concentrations. Their increases (< 100 ppbv) are both above typical concentration levels published for ambient environments; both are substantially below 8 hour occupational health guidelines from OSHA, NIOSH, and ACGIH.

	Timnath Concentration Range (ppb)	OSHA (TWA,8hrs) (ppb)	NIOSH (TWA, 8hrs) (ppb)	ACGIH (TWA 8hrs) (ppb)	Typical Published Conc. (ppb)
Acetone	24-99	1000000	750000	750000	1-17 (forested- urban) ^{1,2}
Isopropanol	11-89	400000	40000	200000	7-44 Urban ³
MEK	0.04-0.9	200000		200000	0.1-2900 ^{4,5}
Ethylbenzene	0.7-7	100000	100000	125000	1-20 ⁴
Xylenes	1-31	100000	100000	100000	0.1-1000 ^{4,6}
Toluene	0.1-3	200000	100000	20000	0.4-1600 ^{4,6}

Table 2: Summary of the results from measurements compared to governmental thresholds and concentrations from other published studies. All concentrations are reported in parts per billion (ppb) elevated above background.

References:

1. Villanueva I. et al., Biogenic emissions and ambient concentrations of hydrocarbons, carbonyl compounds and organic acids from ponderosa pine and cottonwood trees in rural and forested sites in Central New Mexico, *Atmos. Environ.*, (38), 249-260, (2004).
2. Granby K. et al., Urban and Semi-rural observations of carboxylic acids and carbonyls, (31), 10, 1403-1415, (1997).
3. Nguyen H. T. et al., Atmospheric alcohols and aldehydes concentrations measured in Osaka, Japan and in Sao Paulo Brazil. *Atmos. Environ.*, (35), 3075-3083, (2001).
4. Swarthout R. F. et al., Volatile organic compound distributions during the NACHTT campaign at the Boulder Atmospheric Observatory: Influence of urban and natural gas sources. *J. Geophys. Res. – Atmos.*, (118), 10614-10637, (2013).
5. California Environmental Protection Agency, Air Resources Board, <http://www.arb.ca.gov/html/brochure/airtoxic.htm#Risk%20Assessment%20-%20Identifies%20Health%20Risk%20To%20The%20Public>, Last visit: (2016).
6. Air Resource Specialists, City of Fort Collins Data Summary Report (H₂S and VOC), (2013).