City of Fort Collins

AIR QUALITY MONITORING PROJECT

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Overview

- Short-term air monitoring project conducted per Oil and Gas Operator Agreement signed May 21, 2013
  - Establish existing air quality conditions
  - Screening level study to determine if further study is necessary
- Study period: November 15, 2013-February 15, 2014
- Included 5 monitoring locations: 3 at oil field, 2 downtown
- Measured hydrogen sulfide (H_2S), methane, and VOCs typical of both urban and O&G wells

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Monitoring Methods

- Continuous Monitoring *(hourly average)*
  - Continual sampling over 90-day period
  - Hydrogen sulfide (H_2S)
  - Meteorology (e.g. wind speed, wind direction)
- Integrated Sampling *(24-hour average)*
  - 5 sampling episodes
  - Volatile Organic Compounds (VOCs), >80 compounds
    - EPA 1 in 12 day schedule
    - EPA collection and analysis methods

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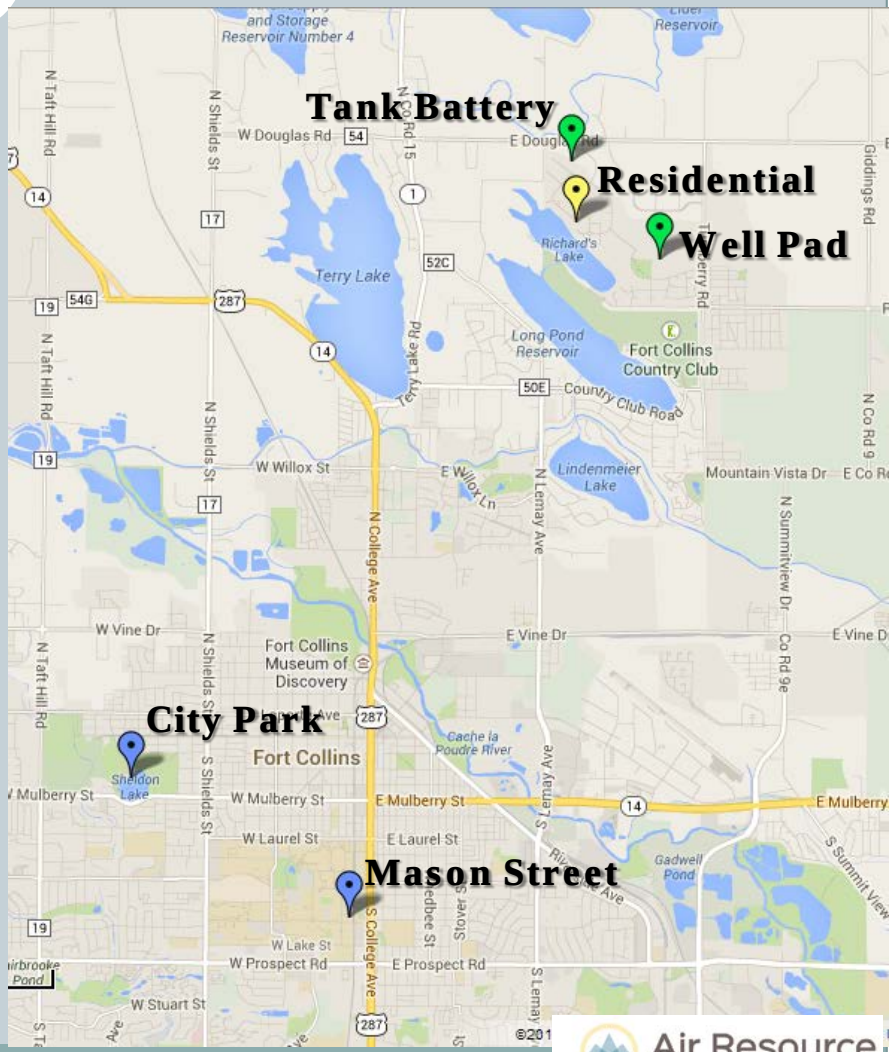
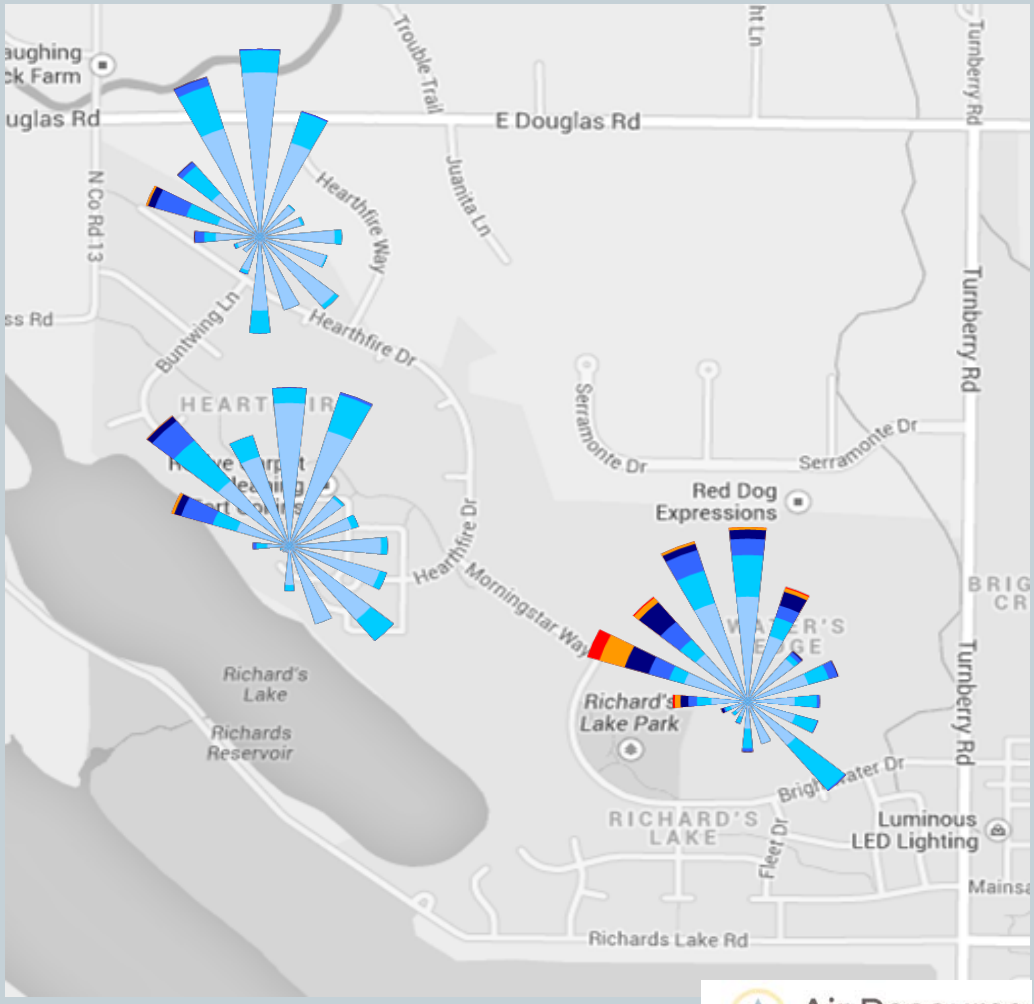
Monitoring Locations

- 3 northeast FC sites
  - *Tank Battery*
    - H_2S and meteorology
    - VOC
  - *Well Pad*
    - H_2S and meteorology
    - VOC
  - *Residential*
    - H_2S and meteorology
- 2 downtown sites
  - *City Park*
    - VOC
  - *Mason Street (CSU)*
    - VOC



Measurement Results - Meteorology

- Meteorological Measurements
  - Wind speed and wind direction: *useful to determine how fast and where pollutants may travel*
  - Wind plots: *show predominant winds between NW and SE*



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Measurement Results – H_2S

- Hourly H_2S readings recorded between 11/15/13 and 2/15/14
- Used instrument for health and safety within the fence-line of well sites *(not odors)*
  - Odor threshold: 0.0005 - 1.5 ppm (levels where it can be smelled)
  - Mild symptoms/effects (e.g. nausea/headache) from prolonged exposure: 2-5 ppm
  - Permissible Exposure Limit (PEL) 10 ppm
  - More serious effects (e.g. dizziness/fatigue) >20 ppm

- Not detected above 1 ppm
  instrument detection limit

Site	Max Value Detected (ppm)
Tank Battery	0
Well Pad	0
Hearth Fire	0

[1]https://www.osha.gov/SLTC/hydrogensulfide/hazards.html

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VOC Measurements

- Each canister analyzed for >80 individual compounds, including:
  - BTEX parameters
    - Benzene, toluene, ethylbenzene and xylenes, which are considered Hazardous Air Pollutants (HAPS)
  - Light Alkanes (e.g. ethane and propane)
    - Associated with natural gas production, but not considered HAPs
  - Methane
    - Associated with natural gas production, considered a "greenhouse gas"

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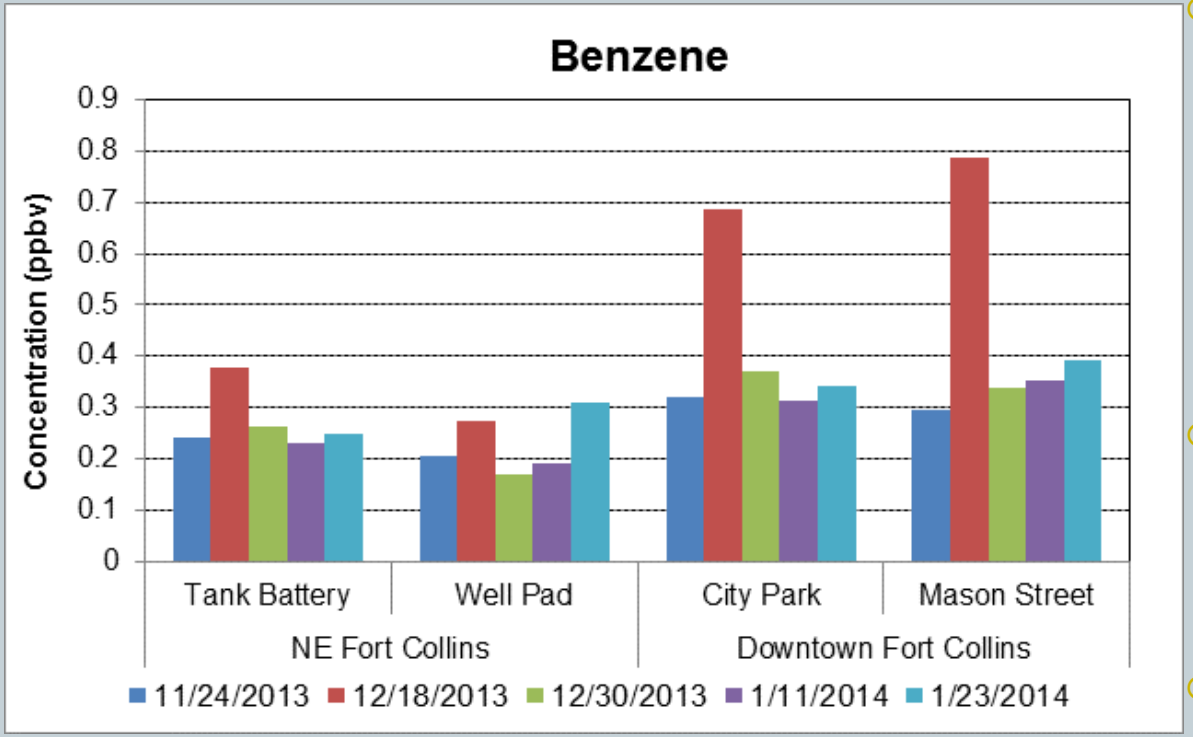
Measurement Results – VOCs
Benzene



Exposure guidelines range from: 100 – 10,000 ppb

- Commonly associated with fuel combustion (e.g. motor vehicles) and evaporative gasoline emissions (e.g. gas stations)
- Higher at City Park and Mason Street Sites near downtown
- Highest measurement on 12/18/13 associated with stagnant air conditions

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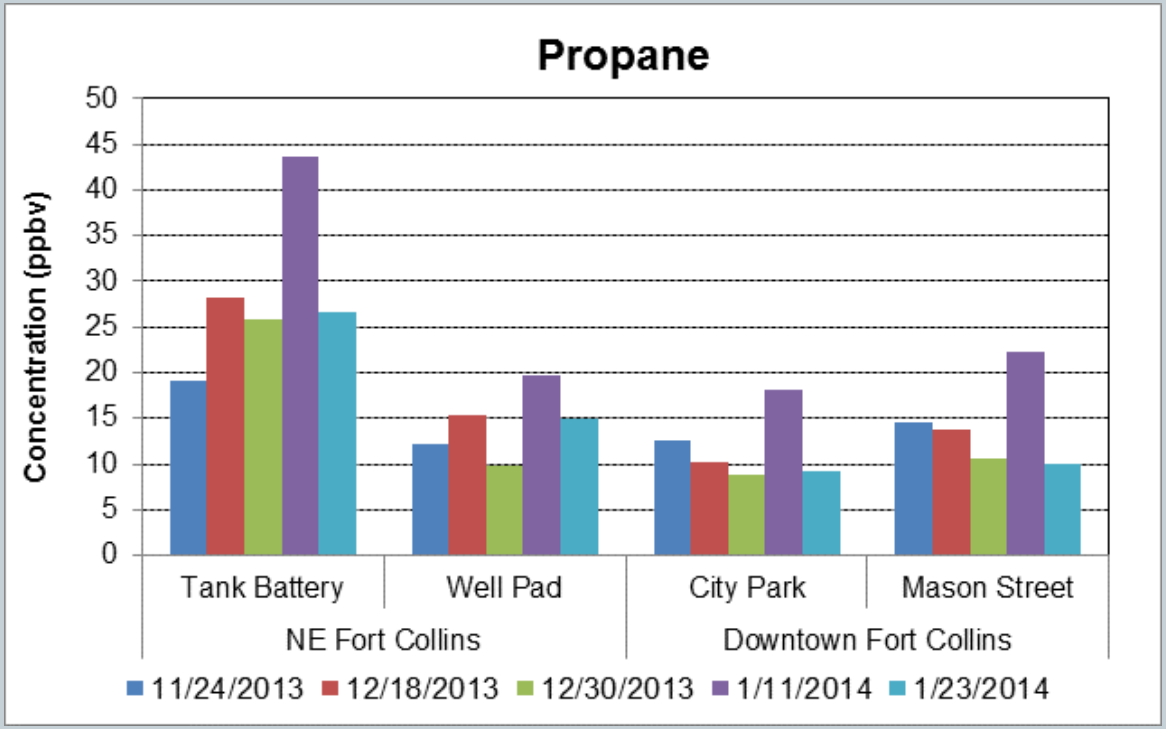
Measurement Results – VOCs
Propane



- Component of natural gas and gasoline vapors
- Commonly associated with Oil and Natural Gas production activities
- Highest at Tank Battery site

Simple asphyxiant, not a HAP
Indicator gas for oil and gas related emissions

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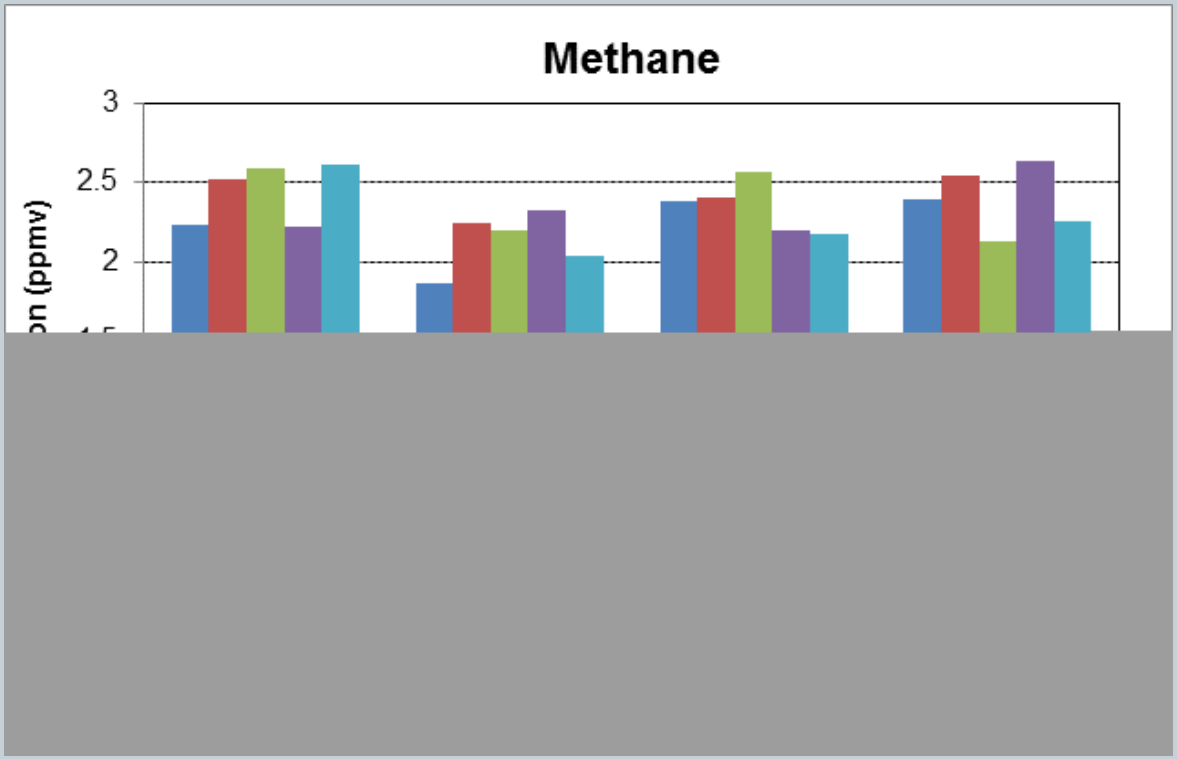
Measurement Results – VOCs
Methane



- Primary component of natural gas
- A potent greenhouse gas
- Can persist in the atmosphere up to 12 years (global background ~2ppm)
- Associated with sources such as oil and gas, landfills , agriculture, wastewater treatment plants

Simple asphyxiant, not a HAP
Indicator of gas leaks

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Regional Comparison

- Compared results to recent studies in the region
  - Fort Collins – summer 2006
  - Platteville – winter 2013-2014
  - Denver – winter 2013-2014
  - Erie – summer 2013

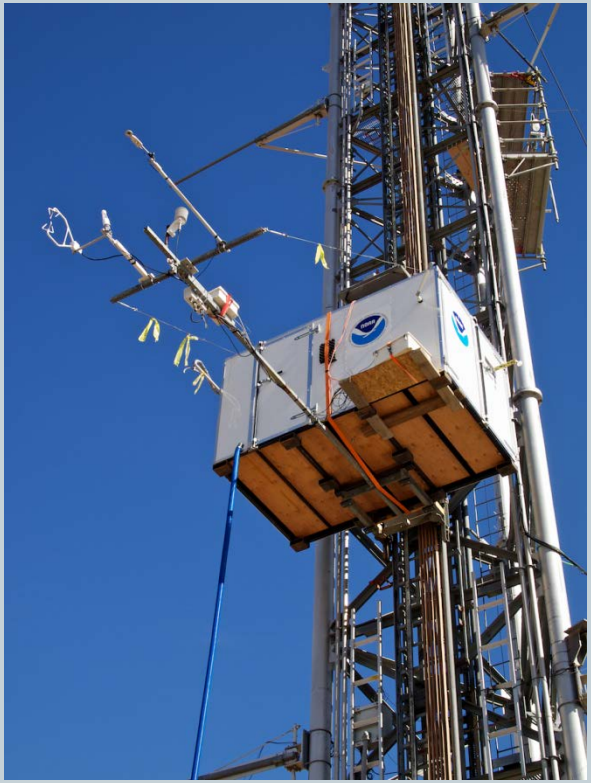

Photo courtesy of NOAA http://www.noaanews.noaa.gov/stories2011/20110301_erie.html

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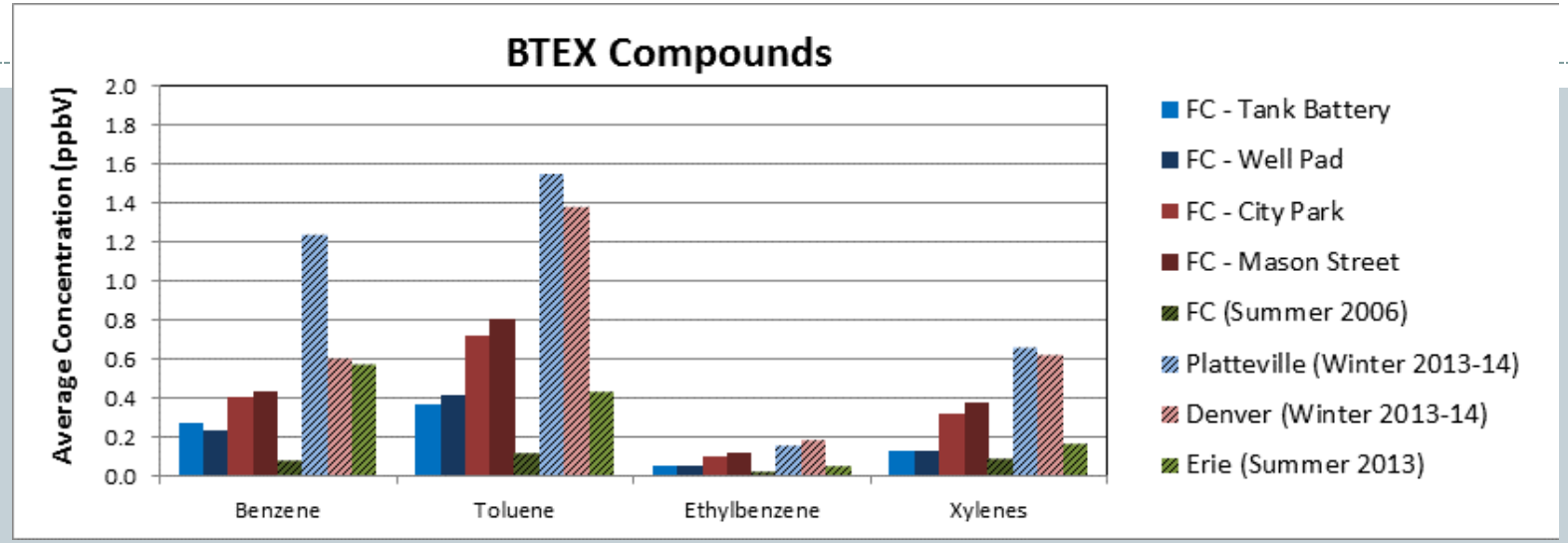
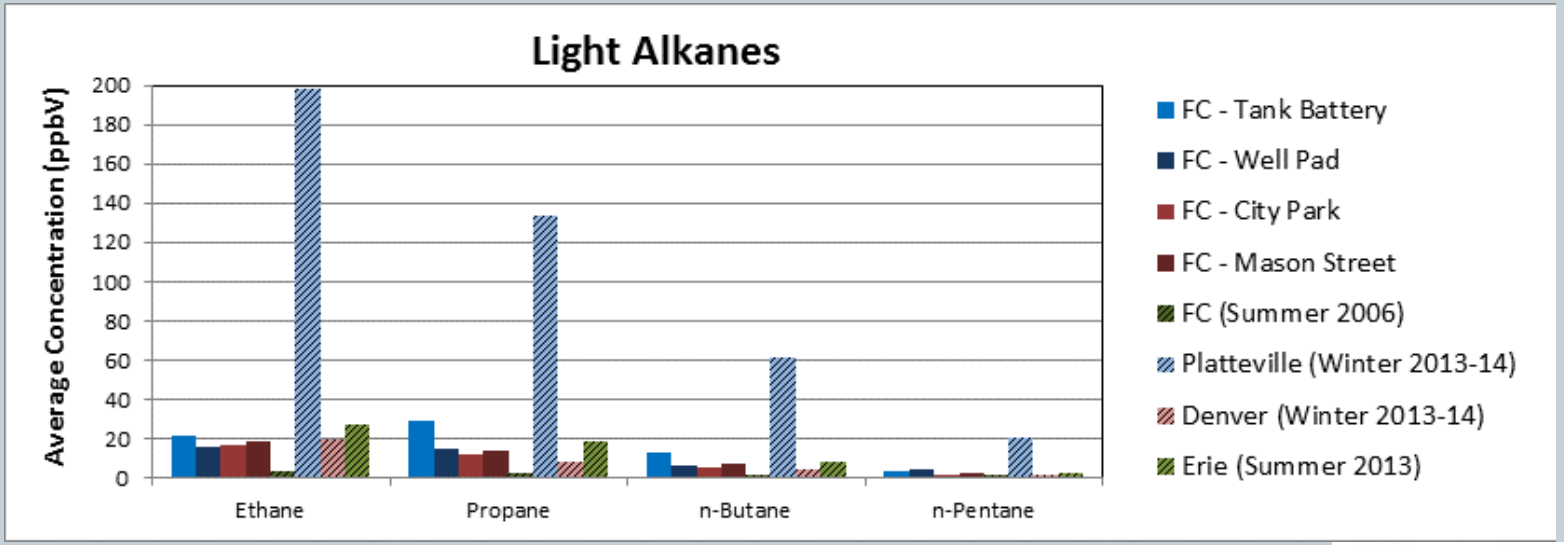
Regional Comparison





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Summary

- Short-term winter monitoring project indicated that:
  - H_2S in the vicinity of O&G operations was not measured at detectable levels
  - Sites in the vicinity of O&G development had lower levels of HAPS (e.g. BTEX) as compared to downtown Fort Collins sites
  - Light hydrocarbons (e.g. propane) were slightly elevated at the "tank battery" site, where loading/unloading operations take place, but not elevated at the "well pad" site, where extraction occurs
  - H_2S, Methane, VOCs and HAPs were not detected at levels of concern that would warrant further study by the City for the existing operations
  - HAPs and BTEX significantly lower at FC sites than other regional O&G and urban sites.

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