Experiences and Lessons Learned with Community Monitoring Near a Refinery

Air Sensor International Conference

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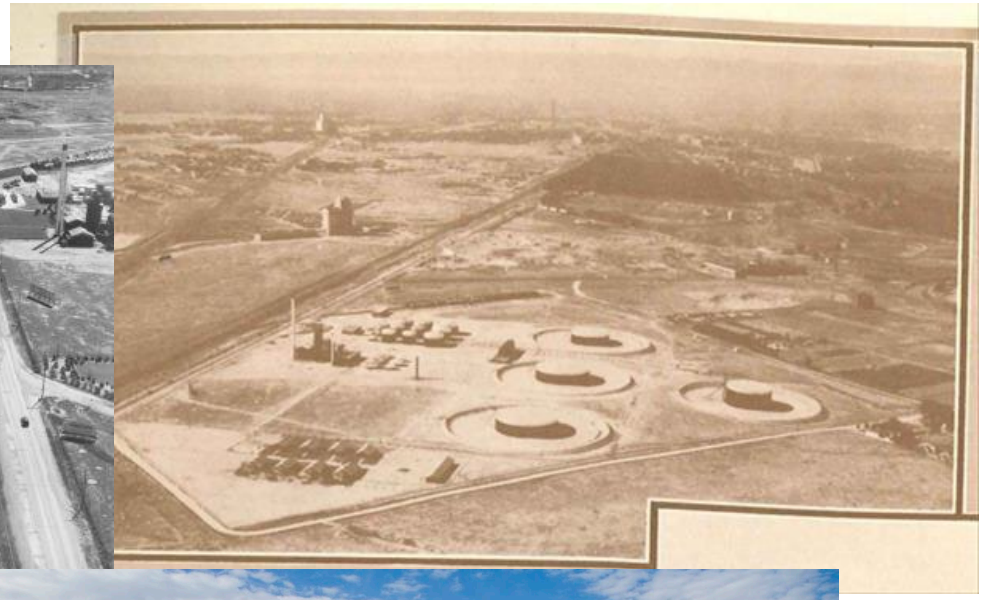
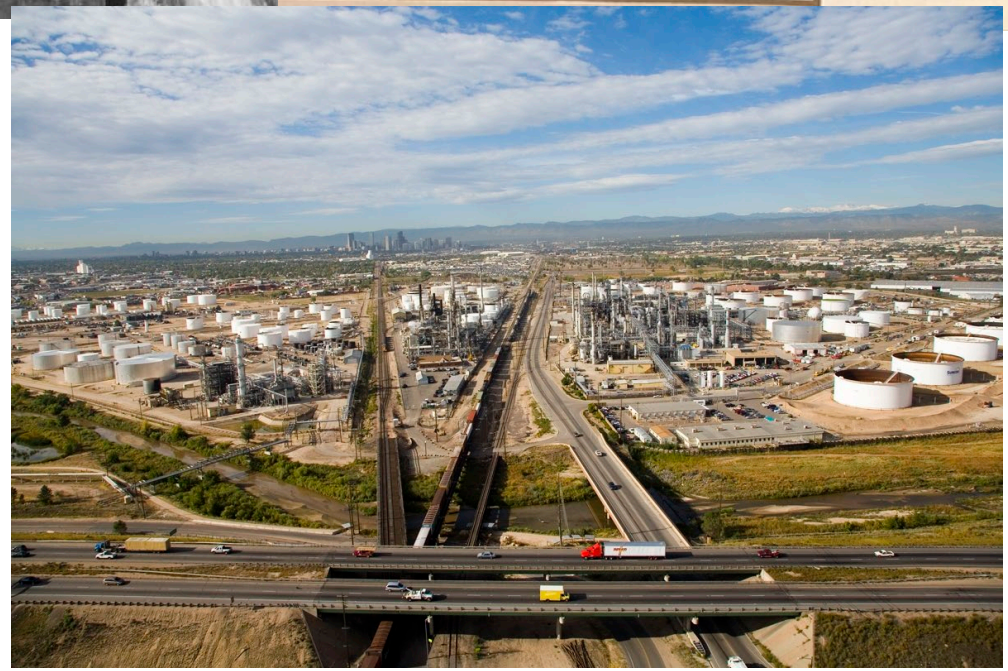
MONTROSE ENVIRONMENTAL

Background

The Commerce City refinery has changed over time, as has the community around it.



- Operational in 1931
- Denver Metro Population in 1930 was 288,000
- Denver Metro Population now is > 3 million



CCND Air Monitoring: program goals

1. **Respond** to the **needs of our neighbors** who told Suncor community air monitoring was a high priority
2. Implement the program in a **coordinated and collaborative manner with existing air monitoring networks in the region**
3. Provide the community with **easy-to-access air monitoring information**, in English and Spanish

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CCND Air Monitoring: program progress

Pre-implementation
(Oct. 2020 – May 2021)

Meetings with regulators, other government stakeholders and the community

COLORADO Department of Public Health & Environment

Commerce CITY

ADAMS COUNTY COLORADO

Tri-County Health Department
Serving Adams, Arapahoe and Douglas Counties

DENVER THE MILE HIGH CITY

Implementation
(June – Aug. 2021)

Equipment testing and deployment by Montrose

Launch of

www.ccnd-air.com

Today and ongoing: Sustainment and continuous improvement

- Quality assurance / quality control checks
- Daily data review and evaluation
- Public feedback monitoring and stakeholder input
- Quarterly data analysis

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Monitoring Program Compounds

Pollutant/Parameter	Impact	Sources
Total volatile organic compounds (tVOC)	Odor, ozone precursor, health	Industry, vehicles, solvents
Specific volatile organic compounds (VOCs)	Odor, ozone precursor, health	Industry, vehicles, solvents
Sulfur dioxide (SO_2)	Health (asthma), smog	Burning coal, industry, volcanos
Nitrogen oxides (NO and NO_2)	Ozone precursor, respiratory health	Vehicles, industry, tobacco
Carbon monoxide (CO)	Health	Industry, vehicles
Hydrogen sulfide (H_2S)	Odors, eye and lung irritant	Industry, geo-thermal
Particulate matter less than 2.5 microns in size ($PM_{2.5}$)	Visibility, health	Industry, vehicles, fires
Wind speed, wind direction, temperature, relative humidity	Source of event identification	NA

Note: *Items shaded green utilize low and mid cost sensors*

Monitoring Program Locations

- **10 locations established**

Location considerations:

- Within three miles of the Commerce City Refinery
- Proximity to other industrial sources
- Wind data taken into account
- Community input
- Nearby buildings and other structures
- Safety, ability to access the site

Monitoring Program Approach

Combination of sensors and techniques

- AQMesh Pods for SO_2, CO, NO, NO_2, H_2S
- Aeroqual AQM65 for SO_2, CO, NO, NO_2, and H_2S
- Lunar Outpost for tVOC, $PM_{2.5}$ and triggered speciated VOC canister collection analysis of 59 analytes
- PTR-TOF-MS mobile platform

Monitoring Program Technology

Proton Transfer Reaction, Time-of-Flight Mass Spectrometer

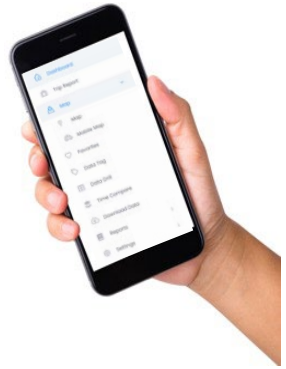
- Quarterly
- Mobile
- Very low detection limits (parts per trillion)
- 64 compounds (typical compound suite in urban and industrial areas)
- Real time and continuous (1 second)
- Weather station and GPS

Example PTR Trace – Chicago Area

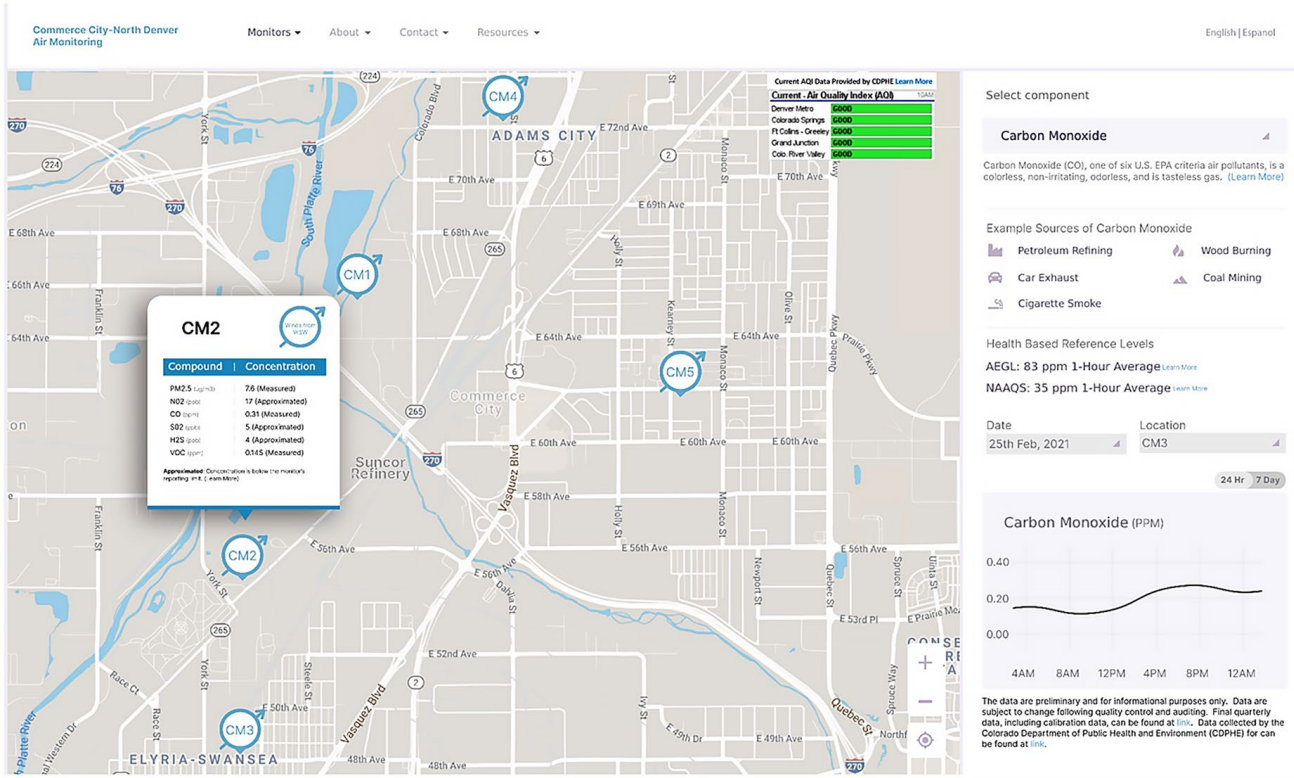
Quality Assurance

- Published monitoring plan
- Initial calibration at multiple concentration levels
- Co-location checks
- Side-by-side study with EPA/CDPHE monitoring stations
- Daily and / or monthly accuracy checks
- Monthly inspections
- Operations and maintenance
- Data platform checks

Monitoring Program Data Platform



- Monitoring equipment communicates to "cloud" platform via cellular technology
- Public-facing webpage includes near real-time readings of monitoring equipment, laboratory analysis and mobile van data
- Resources with information and health standards
- Perform automated system checks (quality control)
  - Regular data accuracy checks (range check, flat line checks, "no data" alerts)
  - Daily network "health" reports
- Exclusive data control by Montrose staff
- Process and initiate collection of canister sample
- Mobile app with City of Denver's Love My Air program
- Automated reporting



Reporting

- Quality assurance (validation checks) summarized
- Data recovery summarized
- High level narrative and program updates and changes
- Comparisons to NAAQS and health based standards (EPA's Acute Exposure Guideline Levels AEGLs)
- Developed and reviewed by toxicologist

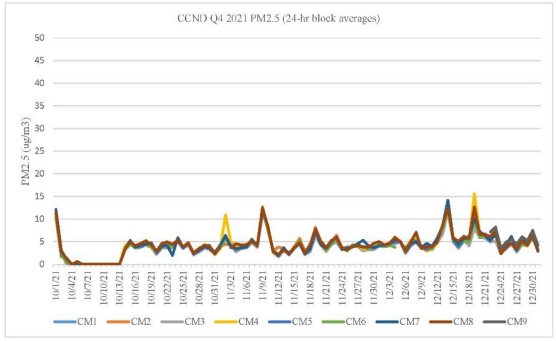
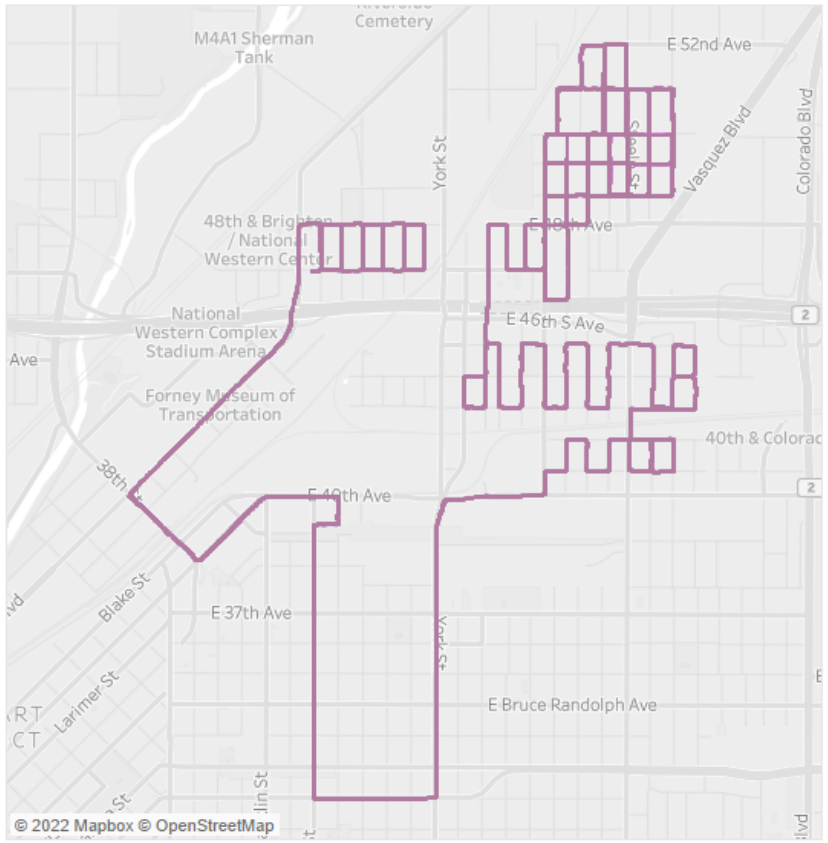


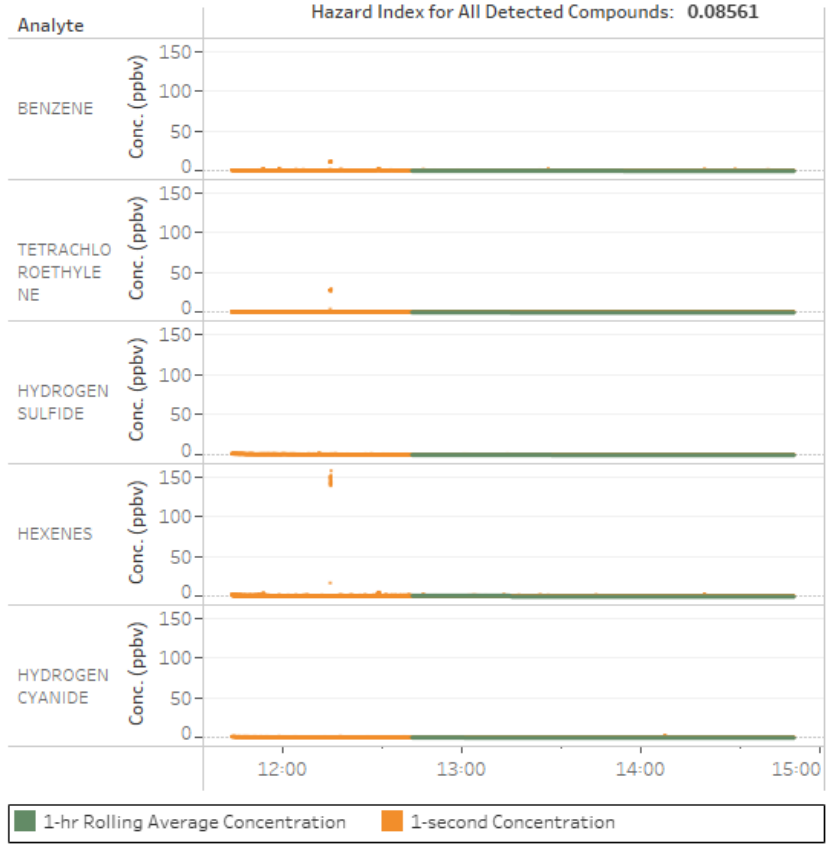
TABLE 1-4
CCND MONITORS RESULTS SUMMARY

Analyte	Sites with Exceedances	NAAQ Standard (duration)	Health-based Reference Value (Source)
CO	None	**35 ppm** (1-hour average not to be exceeded more than one per year)	**83 ppm** (1-hour USEPA AEGL-2)
NO	NA	NA	NA
NO_2	None	**100 ppb** (98th percentile of 1-hour daily maximum, averaged over 3 years)	**500 ppb** (1-hour USEPA AEGL-1)
SO_2	None	**75 ppb** (99th percentile of 1-hour daily maximum concentrations, averaged over 3 years)	**200 ppb** (1-hour USEPA AEGL-1)
H_2S	None	NA	**70 ppb** (acute[5] ATSDR MRL) **510 ppb** (1-hour USEPA AEGL-1)
$PM_{2.5}$	None	**35 µg/m³** (98th percentile of 24-hour daily average concentrations, averaged over 3 years)	NA
VOC	NA	NA	NA

Reporting (PTR -TOF-MS Data)

Analyte	Maximum 1-second Concentration (ppbv)	Count of 1-hr Rolling Averages Derived (#)	Maximum 1-hr Rolling Average (ppbv)	Average 1-hr Rolling Average (ppbv)	AEGL 1 60-min Value (ppbv)	Acute Health Reference Level (ppbv)	Hazard Quotient
BENZENE	11.63	7,683	0.45	0.34	52,000	9	0.04992
TETRACHLOROETHYLENE	28.99	7,683	0.14	0.04	35,000	6	0.02392
HYDROGEN SULFIDE	1.20	7,683	0.39	0.21	510	70	0.00554
HEXENES	156.71	7,683	0.92	0.24	NR	500	0.00184
HYDROGEN CYANIDE	2.51	7,683	0.41	0.22	2,000	308	0.00133





The top 5 hazard quotients are reported in this dashboard. The hazard index represents cumulative risks including all unlisted analytes. The hazard quotient was calculated by comparing the acute health reference level to the maximum 1-hour rolling average. The comparative AEGL value is shown for comparison purposes.

Lessons Learned and Next Steps

- Operational for ~9 months
- Data recovery greater than 95%
- QA has been excellent
- No exceedances to NAAQS or AEGLs
- "Challenges" with solar power for AQM65
- Improvements to look of "sensors"
- Some sensor issues (e.g., dry hot environment)
- Technology advancements through software updates
- Mixed feedback from community, press, regulators, local governments

Thank you!

www.ccnd -air.com

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