



Colorado Department
of Public Health
and Environment

Energy Development: The Connection to Air Quality, Regulations, Permitting & Compliance (Part 1)

Western Colorado Regional Air Quality Collaboration
Meeting #7

Lisa Clarke, Colorado Air Pollution Control Division

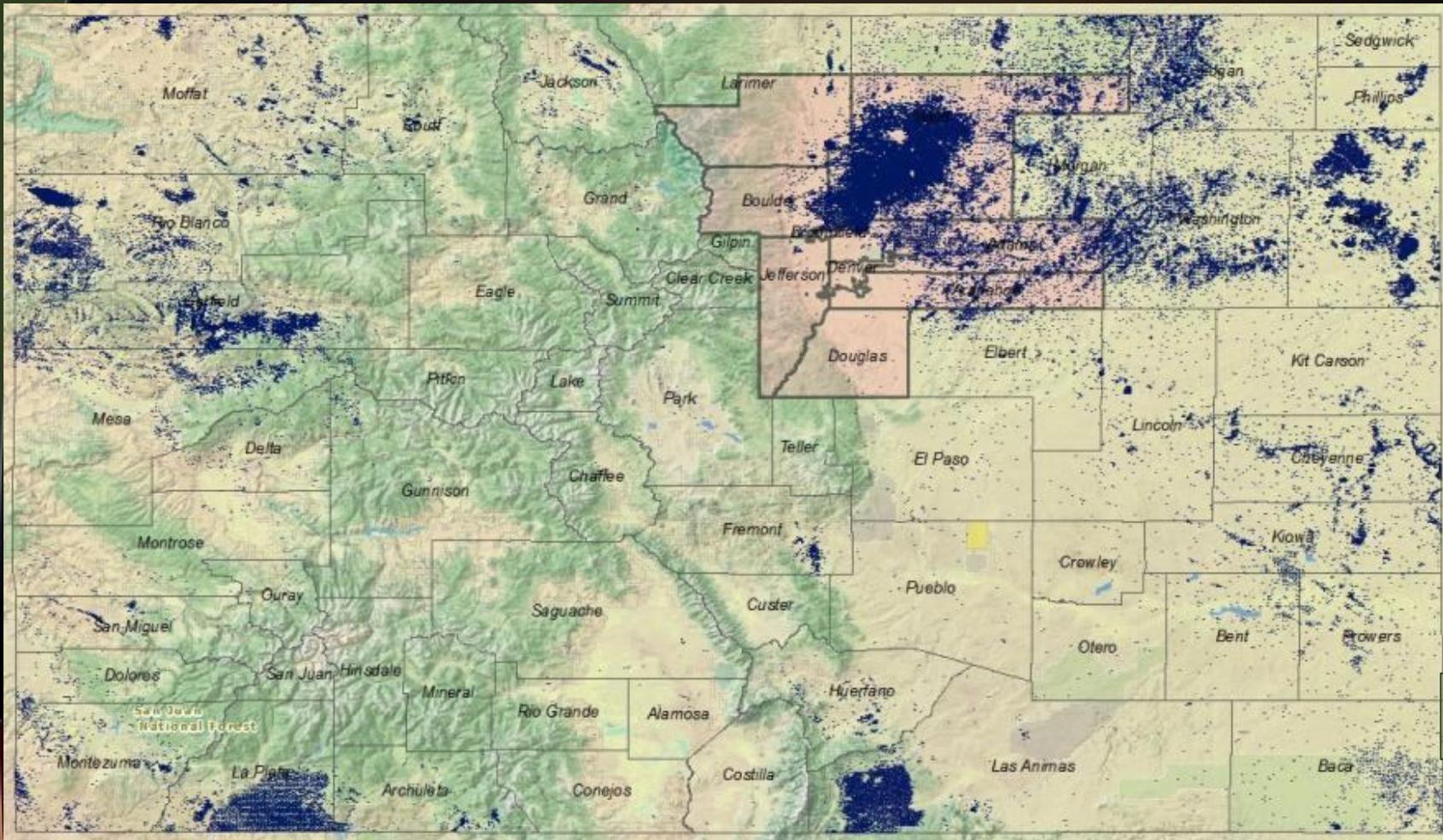


Colorado Department
of Public Health
and Environment

Outline

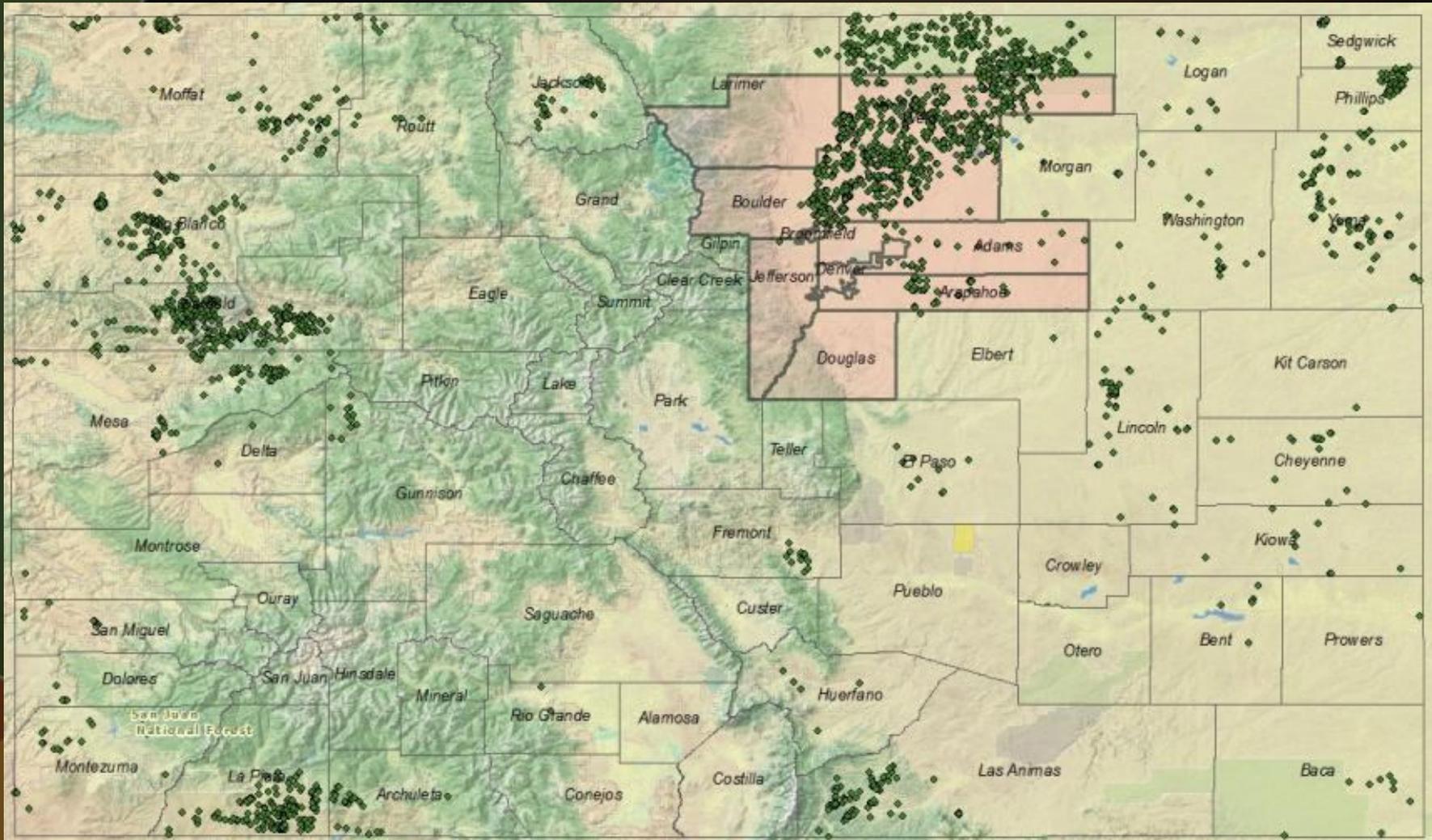
- ▶ Energy Development
 - ▶ Focus on oil and gas development
 - ▶ The link to air quality
 - ▶ Current & recent studies
- ▶ State Agency Roles
 - ▶ Consultation Program
- ▶ Connections

Oil and Gas Wells in Colorado



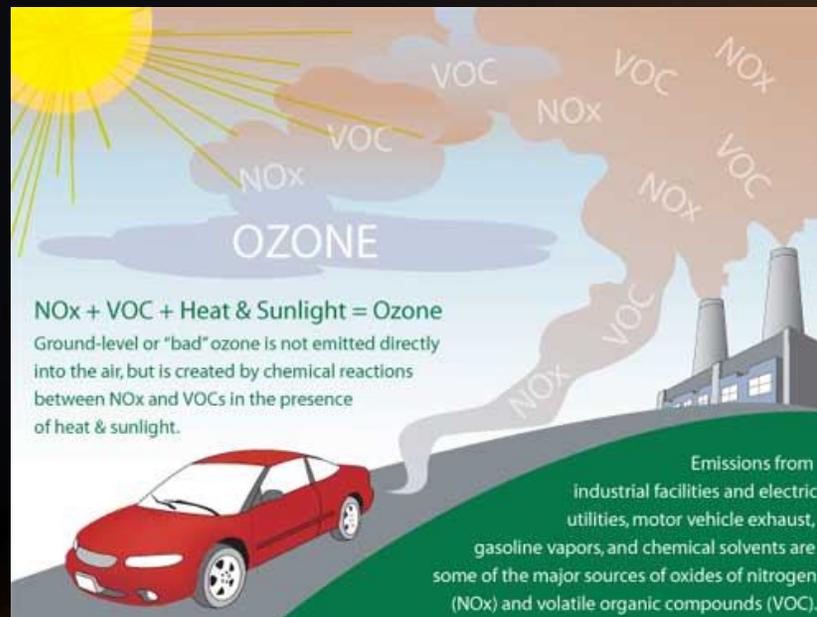
COGCC data
as of 2/2013

Recent Drilling Permits for Oil and Gas Development



COGCC data
2012/2013

Ozone

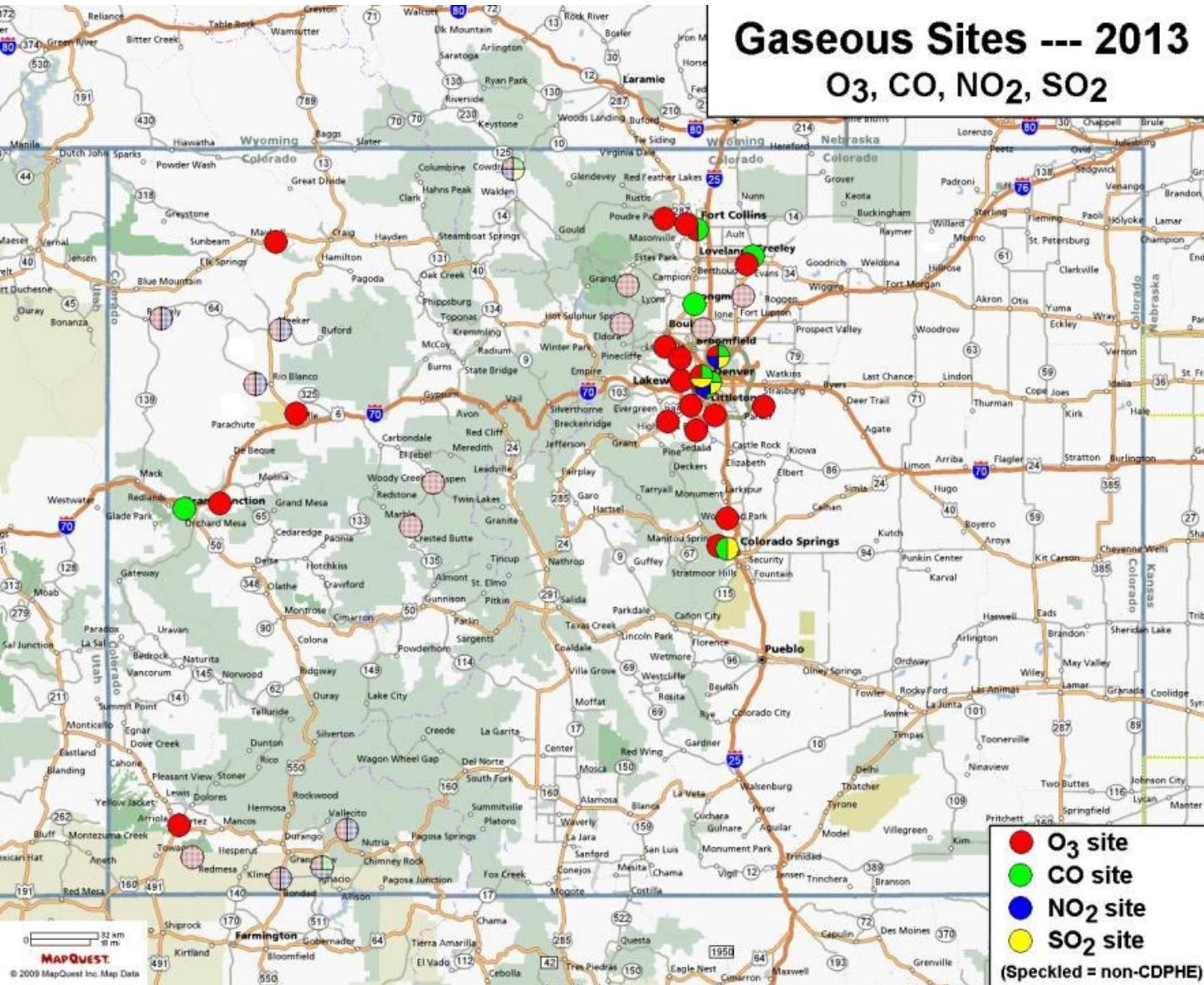


- ▶ Can harm human health
- ▶ Affects sensitive vegetation and ecosystems
- ▶ Emissions from industrial facilities and motor vehicles are major sources of NOx and VOC, the precursors to ozone
- ▶ EPA has established health and environmentally protective standards for ozone in the air
 - ▶ Health standard: 75 ppb (annual 4th highest daily maximum 8-hour concentration, averaged over 3 years)

Gaseous Sites --- 2013

O₃, CO, NO₂, SO₂

Ozone Monitors in Colorado

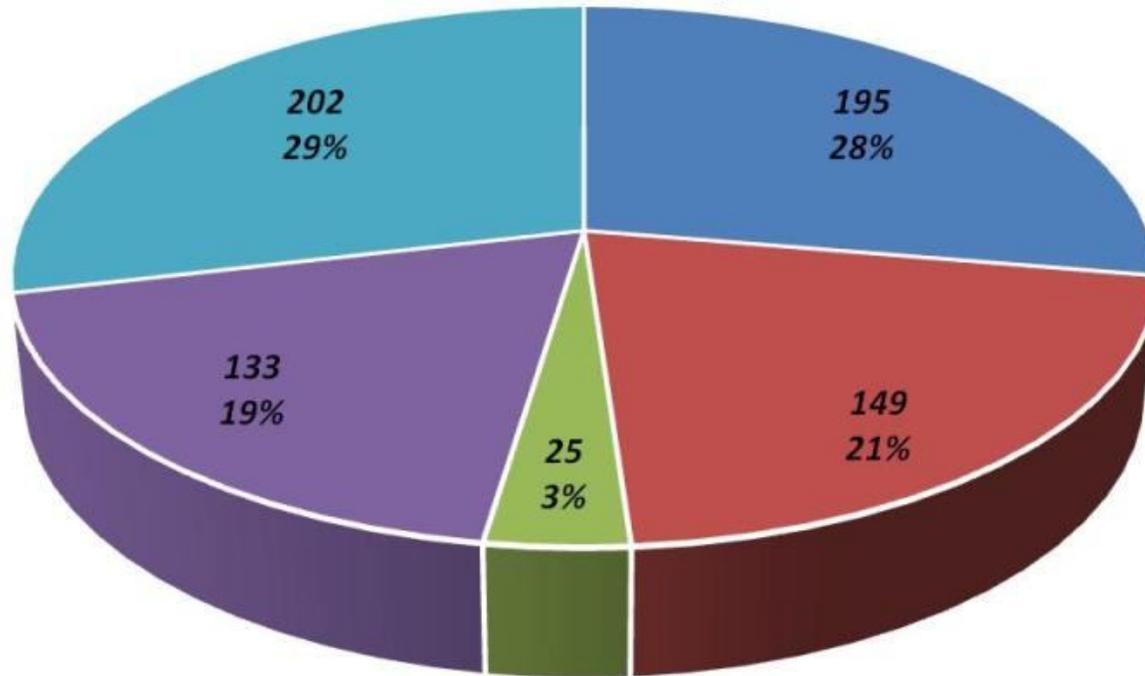


Significant Ozone Precursors

Source Category	NO _x Emissions [tons/day]*		VOC Emissions [tons/day]*	
	Statewide	9-County Ozone NAA	Statewide	9-County Ozone NAA
Point	195 (28%)	65 (21%)	37 (4%)	20 (4%)
Oil & Gas	149 (21%)	51 (16%)	463 (47%)	291 (52%)
Area	25 (3%)	13 (4%)	206 (21%)	105 (19%)
Non-Road Mobile	133 (19%)	68 (22%)	91 (9%)	41 (7%)
On-Road Mobile	202 (29%)	115 (37%)	189 (19%)	106 (19%)
Totals:	704	312	986	563

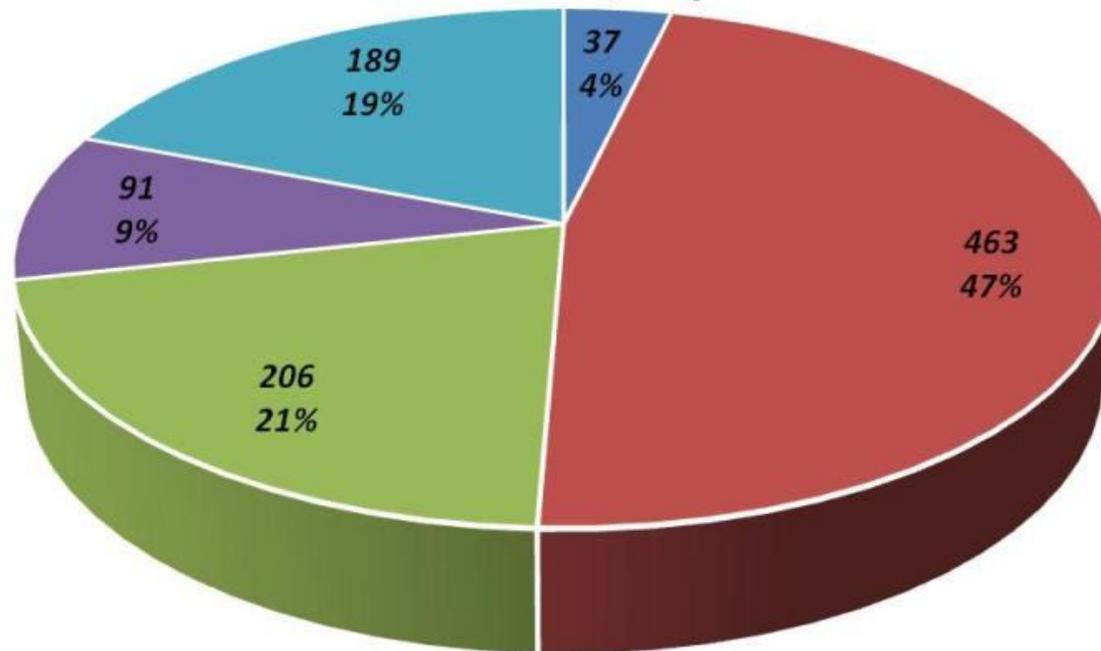
*2010 data

**Colorado (Statewide)
2010 - Anthropogenic NO_x Emissions
704 tons/day**



- Point
- O&G Point and Area
- Area
- Non-Road Mobile
- On-Road Mobile

**Colorado (Statewide)
2010 - Anthropogenic VOC Emissions
986 tons/day**



- Point
- O&G Point and Area
- Area
- Non-Road Mobile
- On-Road Mobile

Recent Studies: Community Health Risk Analysis of Oil and Gas Industry Impacts in Garfield County (2008)

- ▶ Three-pronged approach for assessment of human health risks: community focus groups, human health risk assessment, and data analysis and communication
- ▶ Primary Conclusion: Based on data sources, there is not a health crisis in Garfield County, but some health trends should be monitored. Cannot say any of these health trends are directly related to presence of natural gas industry activities or other factors
- ▶ <http://www.garfield-county.com/environmental-health/human-health-risk-of-oil-gas.aspx>



Recent Studies: Garfield County Health Consultation prepared by CDPHE in Cooperation with ATSDR (2008)

- ▶ Screening-level risk assessment of potential human health impacts from inhalation of air toxics, including Volatile Organic Compounds (VOCs) in Garfield County
- ▶ Primary Conclusion: Ambient air quality in Garfield County constitutes an indeterminate public health hazard, for all current exposures, based on estimated theoretical cancer risks as well as noncancer hazards and uncertainties associated with available data
- ▶ <http://www.garfield-county.com/environmental-health/human-health-risk-of-oil-gas.aspx>



Recent Studies: Garfield County Health Consultation prepared by CDPHE in Cooperation with ATSDR (2010)

- ▶ Screening-level risk assessment of potential human health impacts from inhalation of air toxics, including Volatile Organic Compounds (VOCs) in Garfield County
- ▶ Primary Conclusion: Cannot currently be determined if breathing ambient air in the monitored area of Garfield County could harm people's health. Cancer risks and noncancer hazards for 65 out of 86 contaminants cannot be quantitatively estimated due to limited toxicological information
- ▶ <http://www.garfield-county.com/environmental-health/human-health-risk-of-oil-gas.aspx>

Recent Studies: Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources

- ▶ Colorado School of Public Health 2012
- ▶ Risk assessment can be used as a tool in Human Impact Assessments where and when public health is most likely to be impacted
- ▶ Preliminary results indicate health effects from air emissions during development of natural gas resources most likely to occur in residents living nearest to well pads and warrants further study

Recent Studies: Hydrocarbon Emissions Characterization in the Colorado Front Range – A Pilot Study

- ▶ Petron et. al. (NOAA) 2012
 - ▶ Analysis of 300-m tall tower in SW corner of Weld County reveals a strong alkane and benzene signature in the air masses coming from NE Colorado
 - ▶ Measured alkanes indicate Weld County methane emissions from oil and gas production and processing in Colorado most likely underestimated methane attributed to natural gas by factor of two
- ▶ http://blogs.edf.org/energyexchange/files/2012/02/Petron_Colorado_Front_Range_2011.pdf



Recent Studies: Air Emissions Case Study Related to Oil and Gas Development in Erie, Colorado

▶ CDPHE 2012

- ▶ Concentrations of likely O&G related compounds such as ethane and propane were found to be slightly higher at the Erie sites than in downtown Denver, but much lower than in Platteville, where greater oil and gas activity is taking place
- ▶ Monitored concentrations of benzene well within acceptable limits to protect public health (EPA)
- ▶ http://www.colorado.gov/airquality/tech_doc_repository.aspx?action=open&file=Erie_Air_Emissions_Case_Study_2012.pdf

Recent Studies: An Exploratory Study of Air Quality near Natural Gas Operations

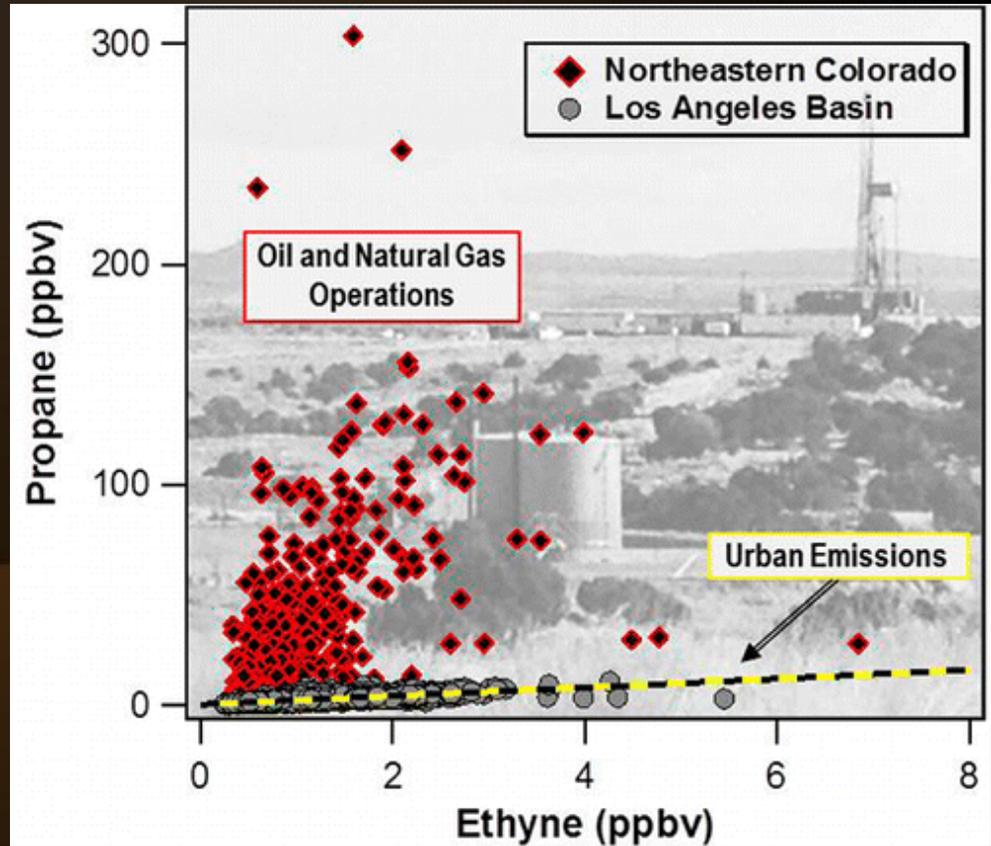
- ▶ The Endocrine Disruption Exchange (TEDX) 2012
 - ▶ Designed to assess air quality in rural western Colorado area where residences and gas wells co-exist. Weekly air sampling over 1 year revealed number of non-methane hydrocarbons highest during initial drilling phase and did not increase during hydraulic fracturing
 - ▶ Methylene chloride detected 73% of the time; several times in high concentrations. Concentrations at which these chemicals detected in the air far less than U.S. government safety standards
 - ▶ <http://www.endocrinedisruption.com/chemicals.air.php>

Recent Studies: Source Signature of Volatile Organic Compounds from O&NG Operations in NE Colorado

▶ CIRA 2013

- ▶ Extensive set of VOCs measured at Boulder Atmospheric Observatory (BAO) in winter 2011 to investigate composition and influence of VOC emissions from O&NG operations in NE Colorado
- ▶ VOC source signature associated with O&NG operations clearly differentiated from urban sources dominated by vehicular exhaust
- ▶ VOCs emitted from O&NG operations are evident at all three measurement sites in NE Colorado
- ▶ Conclude that these emissions are significant source of ozone precursors

Recent Studies: Source Signature of Volatile Organic Compounds from O&NG Operations in NE Colorado



Upcoming: Garfield County Gas Emissions Study

- ▶ CSU partnering with Garfield County and industry to assess air emissions from well development and completion
 - ▶ 3 yr study
 - ▶ Quantify emissions of chemical compounds (especially VOCs) during well development operations
 - ▶ Characterize how these compounds are dispersed in the atmosphere in the downwind plume near the site
- ▶ Funding provided by Garfield County and local operators
 - ▶ Government involvement important - ensures public is well represented
 - ▶ Industry involvement - critical to ensure full site access and access to operational information relevant to emissions
 - ▶ Study not yet fully funded





Upcoming Studies: North Front Range Emissions and Dispersion Study (CDPHE)

- ▶ Proposed for 7/2013 – 6/2016
- ▶ Protocols similar to CSU Garfield Study
- ▶ Focus on oil and gas activities in the D-J basin/Wattenberg field
 - ▶ Drilling, fracking/flowback/completion
 - ▶ Production
 - ▶ Processing
- ▶ Technical advisory group – scientists, industry,
- ▶ Ensure more robust data available for future use
- ▶ Not fully funded (Phase I is funded pending legislature approval)

Upcoming Studies – Others

- ▶ CU NSF Sustainability Research Network (SRN) study
- ▶ NOAA Front Range measurements continuation
- ▶ NCAR Front Range Air Pollution and Photochemistry Experiment (FRAPPÉ)
- ▶ NASA DISCOVER-AQ mission
- ▶ EDF-sponsored CH₄ leakage studies

Study Conclusions

- ▶ Approximately eight Colorado-area studies related to Oil and Gas in past 5 years
 - ▶ No direct human health impacts shown
- ▶ Obvious desire for more studies – at least five more studies in progress or up for proposal
- ▶ Previous studies show a more holistic approach regarding specific emissions from oil and gas connected to human health impacts are needed
- ▶ Further understanding about impacts from multiple pollutants and long-term human health impacts is essential



High Level Observations – Oil and Gas Emissions in Colorado

- ▶ Oil and Gas operations significantly contribute to air emissions in Colorado
- ▶ Oil and Gas emissions impact multiple areas across the state
- ▶ Future development opportunities will likely increase oil and gas air emissions and result in impacts for more areas of the state
- ▶ Oil and Gas sector is the predominant source of VOC emissions
- ▶ Oil and Gas sector is one of several contributors to NO_x emissions
 - ▶ Significant NO_x emission reductions over the next 5 years due to Regional Haze rules and vehicle fleet turnover

State Agency Roles: O&G Industry Environmental Requirements

COGCC

CDPHE

APCD



Colorado Department
of Public Health
and Environment



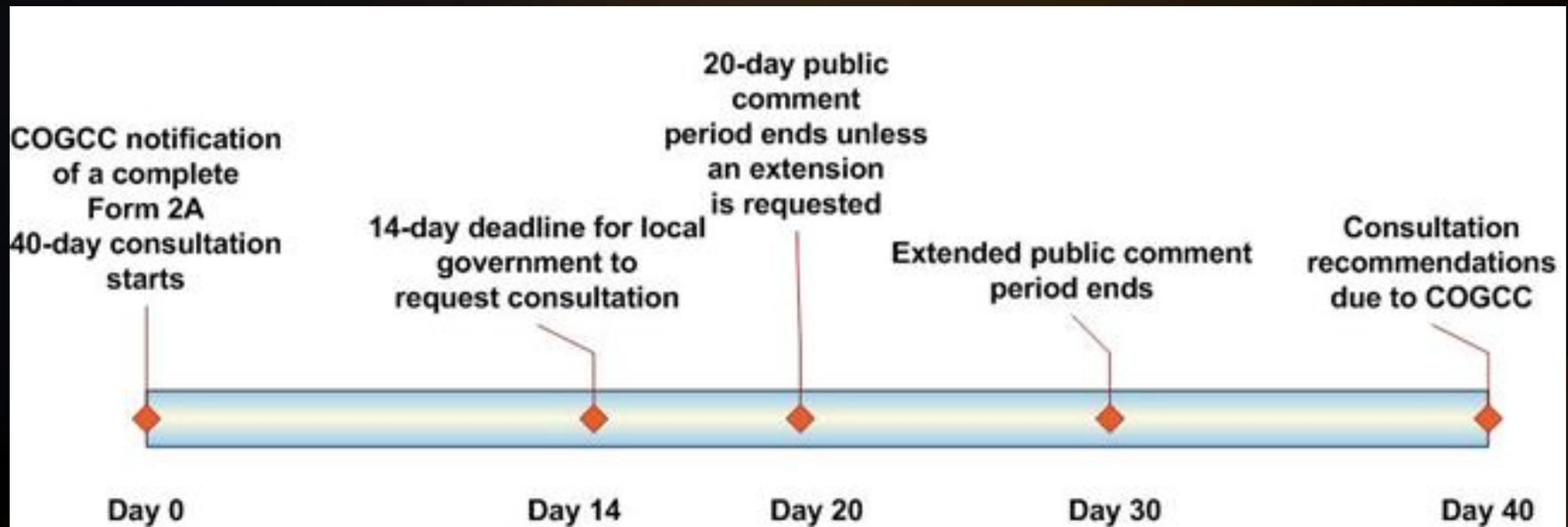
CDPHE Oil and Gas Consultation Program

- ▶ 2007 Legislature directed COGCC to promulgate rules in consultation with CDPHE “to protect health, safety, and welfare of the general public in the conduct of O&G operations”
- ▶ COGCC Rules 305 and 306d set forth how CDPHE consultation is to occur
- ▶ Took effect in April-June 2009
- ▶ Triggered by O&G operator request for variance from certain provisions of the Rules that are designed to protect public health, safety and welfare or the environment OR local government designee requests within 14 days of Form 2A Application

CDPHE Oil and Gas Consultation Program



Colorado Department
of Public Health
and Environment



Connecting Air Quality & Regulations



Colorado Department
of Public Health
and Environment

Air Quality Information →

- ▶ Oil and gas well data
- ▶ Inventory data
- ▶ Monitor data
- ▶ Ozone health effects knowledge
- ▶ Multiple studies

APCD Regulatory Updates & Proposed Control Strategies

- ▶ Expand control requirements for storage tanks
- ▶ Enhance capture at controlled storage tanks
- ▶ Expand non-attainment area auto-igniter requirements to rest of the state
- ▶ Expand leak detection and repair requirements
- ▶ Reduce venting and flaring of gas stream at well sites
- ▶ Expand existing low-bleed pneumatic requirements to rest of the state

Part 2

- ▶ Regulations in Detail
- ▶ Air Permits
 - ▶ Types, sources affected
- ▶ Compliance and Enforcement
- ▶ Guest speakers from other APCD Programs

Questions/Comments?

