SLIDES: Regulating Oil and Gas Emissions in the Denver Julesberg Basin

Garry Kaufman

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Regulating Oil and Gas Emissions in the Denver Julesburg Basin

Garry Kaufman
Deputy Director
Colorado Air Pollution Control Division
June 6, 2014
Overview

- Air quality need for oil and gas emission reductions

- Past efforts
  - 8-Hour Ozone Early Action Compact
  - 8-Hour Ozone Action Plan

- 2014 Oil and Gas Rulemaking

- Conclusions
Historically oil and gas emission reduction strategies implemented to address violations of the ozone National Ambient Air Quality Standard in the Denver Metro/North Front Range Area

- Primarily volatile organic compound (VOC) reduction strategies

2014 rulemaking also considered methane reductions as part of Colorado’s efforts to address global climate change
### Three Year Average 4th Maximum Ozone Values

***2013 data through 30 September***

<table>
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<tr>
<th>Site Name</th>
<th>AQS #</th>
<th>2011 8-hr. O3 4th Max Value (ppm)</th>
<th>2012 8-hr. O3 4th Max Value (ppm)</th>
<th>2013 8-hr. O3 4th Max Value (ppm)</th>
<th>3-yr. Avg. 4th Max Value (ppm)</th>
<th>2014 Highest Allowable 4th Max Value (ppm)</th>
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* Rist Canyon site closed 6/28. (NOAA thru 6/23)
Colorado (9-County NAA)
2011 - Anthropogenic VOC Emissions
538 tons/day

- Point: 39.2 tons (7%)
- Area: 75.8 tons (14%)
- On-Road Mobile: 89.3 tons (17%)
- O&G (permitted & unpermitted): 26.5 tons (5%)
- Non-Road Mobile: 306.6 tons (57%)
### 2018 DVF Projections O&G Sens Tests

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<th>ID</th>
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</table>
Past Efforts

- Prior to the early 2000’s oil and gas sector was considered to be an insignificant contributor to VOC emissions in the Denver Metro/North Front Range Area.

- Until 2003, condensate storage tanks at oil and gas production facilities were exempt from reporting and permitting requirements.

- Little or no understanding of the potential for VOC leakage and venting at oil and gas production facilities.
Past Efforts

- In early 2000’s APCD discovered that “flashing” at condensate storage tanks was a significant source of VOC emissions in DMA/NFR
  - “flashing” occurs when petroleum liquid that is under high pressure underground is put into an atmospheric tank
  - Previously APCD assumed that emissions from tank were limited to evaporative losses (working and breathing losses)

- For 2002 estimated flashing emissions in DMA/NFR of 134 tons per day
  - 2004 Early Action Compact emission inventory
Colorado (9-County O3 NAA)
2002 - Anthropogenic VOC Emissions
516 tons/day

- Point: 152.8 tons (30%)
- Area: 73.1 tons (14%)
- On-Road Mobile: 96.9 tons (19%)
- O&G (permitted & unpermitted): 138.0 tons (27%)
- Non-Road Mobile
Past Efforts: 2004 EAC

To avoid 8-hour Ozone NAAQS non-attainment designation for the DMA/NFR, Colorado entered into Early Action Compact with EPA in 2004 (EAC), which included 1st Colorado regulations for reducing VOC emissions from oil and gas operations

- Operators in DMA/NFR required to reduce condensate tank emissions by 47.5% on a system-wide basis during ozone season (May 1–September 30)
  - Lesser control level during rest of year
- Control dehydrators emitting 15 tpy or greater VOC
- Engine controls
- Leak detection at existing gas plants
Past Efforts: 2006 EAC

- 2004 condensate tank emission reduction requirements assumed modest growth in emissions
  - 2002 uncontrolled emissions = 134 tpd
  - 2007 projected uncontrolled emissions = 146 tpd

- By 2006 it was clear that growth in tank emissions was significantly underestimated
  - 2006 uncontrolled emissions = 211 tpd

- To address growth Air Quality Control Commission increased tank control percentage
  - 75% control during ozone season starting in 2007
  - 78% control during ozone season starting in 2012
Past Efforts: 2006 EAC

- All tanks required to be controlled during 1st 90 days of production
  - Production/emissions highest during this period and declines thereafter
  - Prior to 2006, tanks were not being controlled during this initial period to allow operators to determine expected production/emissions

- Additional monitoring, recordkeeping and reporting requirements to enhance compliance

- New state-wide rules to proactively address oil and gas emissions outside the DMA/NFR
Past Efforts: 2008 Ozone Action Plan

- DMA/NFR 8-Hour Ozone non-attainment designation in 2007

- Extensive inventory analysis and photochemical modeling to identify controls and demonstrate projected compliance with standard by 2010

- Additional oil and gas emission reduction strategies
  - Increase tank control percentage (81% in 2009, 90% in 2011)
  - Low-bleed pneumatic requirement (projected 23 tpd emission reduction)
2008 OAP VOC Inventory

Colorado (9-County O3 NAA)
2006 - Anthropogenic VOC Emissions
479 tons/day

- Point: 129.7 tons (27%)
- Area: 65.3 tons (13%)
- On-Road Mobile: 66.3 tons (14%)
- O&G (permitted & unpermitted): 185.2 tons (39%)
- Non-Road Mobile: 32.1 tons (7%)
2008 OAP Oil and Gas Inventory

Colorado (9-County NAA)
2006 O&G Sources
VOC Emissions - 185.2 tons/day

- O&G - Tanks
- O&G Area - Venting/Fugitives
- O&G Area - Pneumatics/Pumps
- O&G Area - Engines/Rigs
- O&G Point Sources

- 126.5 68%
- 24.8 13%
- 16.2 9%
- 10.8 6%
- 6.8 4%
New rules target VOC and methane emissions from the oil and gas production sector
- 1st in the nation rules to specifically require methane emission reductions from O&G

New rules expected to reduce VOC emissions by approximately 94,000 tpy, methane emissions by approximately 64,000–113,000 tpy, at an overall annual cost of approximately $42 million

New rules establish emission reduction requirements for the largest O&G source categories
- Tanks
- Fugitives/Venting
- Pneumatic devices
Oil and Gas VOC Emissions

Colorado (Statewide) 2011 O&G Sources VOC Emissions - 576 tons/day

- 116.4 (20%)
- 51.4 (9%)
- 29.9 (5%)
- 19.4 (3%)
- 11.9 (2%)
- 3.0 (1%)

- O&G - Tanks
- O&G Area - Venting/Fugitives
- O&G Area - Pneumatics/Pumps
- O&G Point - Industrial Processes
- O&G Point - Evaporation
- O&G Point - Engines
- O&G Area - Engines/Rigs
Colorado (9-County NAA) 2011 O&G Sources VOC Emissions - 306.6 tons/day

- **242.7** 79% O&G - Tanks
- **40.1** 13% O&G Area - Venting/Fugitives
- **6.7** 2% O&G Area - Pneumatics/Pumps
- **5.4** 2% O&G Point - Industrial Processes
- **6.5** 2% O&G Point - Evaporation
- **4.3** 2% O&G Point - Engines
- **0.8** 0% O&G Area - Engines/Rigs
Storage Tank Reduction Strategies

- Expand control requirements for storage tanks
  - Lower statewide control threshold from 20 tons per year to 6 tons per year
  - Include crude oil and produced water storage tanks
  - Require controls during the first 90 days of production statewide

- Improve capture of emissions at controlled tanks
  - Controlled tanks must be operated without venting to the atmosphere
  - Establish requirements for Storage Tank Emission Management systems (STEM)
    - Capture performance evaluation
    - Certified design to minimize emissions
    - Extensive instrument based monitoring
    - Continual improvement
Storage Tank Capture Requirements

- Emission reduction benefits from storage tank controls premised on capturing emissions and routing them to the control device

- Input pressure for many controlled tanks is too high (above atmospheric)
  - During high pressure dumps to the tank, the pressure relief valve (PRV) and thief hatch may release to prevent tank failure
  - Results in uncontrolled flashing losses from thief hatch and PRV
Leak Detection and Repair

- Establish LDAR requirements for compressor stations and well production facilities
  - Frequent monitoring using Method 21 or infra-red (IR) cameras
    - Tiered monitoring schedule to focus on the highest emitting facilities and reduce the burdens on smaller facilities
    - Establishes the most comprehensive leak detection program for oil and gas facilities in the nation
  - Repair schedule for identified leaks
  - Recordkeeping and reporting requirements
Additional Emission Reduction Strategies

- Expand low-bleed pneumatic controller requirements statewide
- Require capture or control of the gas stream at well production facilities
- Establish requirements to minimize emissions during well maintenance
- Require auto-igniters on all combustion devices
- Expand control requirements for glycol dehydrators
  - Lower control threshold from 15 tons per year to 6 tons per year
  - More stringent threshold for facilities near populated areas
Technical Support for 2014 Rulemaking

- Significantly enhanced inventories
- More refined photochemical modeling
- EPA sponsored cost and benefit analyses
- Bottom–up surveys of oil and gas emissions
- Top–down inventory assessments
  - Ground based measurements
  - Airplane measurements
- Infra–red leak detection
- Sophisticated measurements of incomplete tank emission capture
Conclusions

- Advances in drilling technologies and the resultant increases in production in the DJ Basin have created potential significant additional impacts on air quality resources.

- Increased knowledge of oil and gas emissions, better monitoring techniques, and advances in control technologies has allowed us to address these potential impacts.

- Ongoing assessment of emissions and further refinement of control technologies should allow us to further minimize air impacts from oil and gas development.