

2007-08 Ozone Stakeholder Meetings

Clearing the Air: The Benefits of Reducing Emissions from the Oil & Gas Sector

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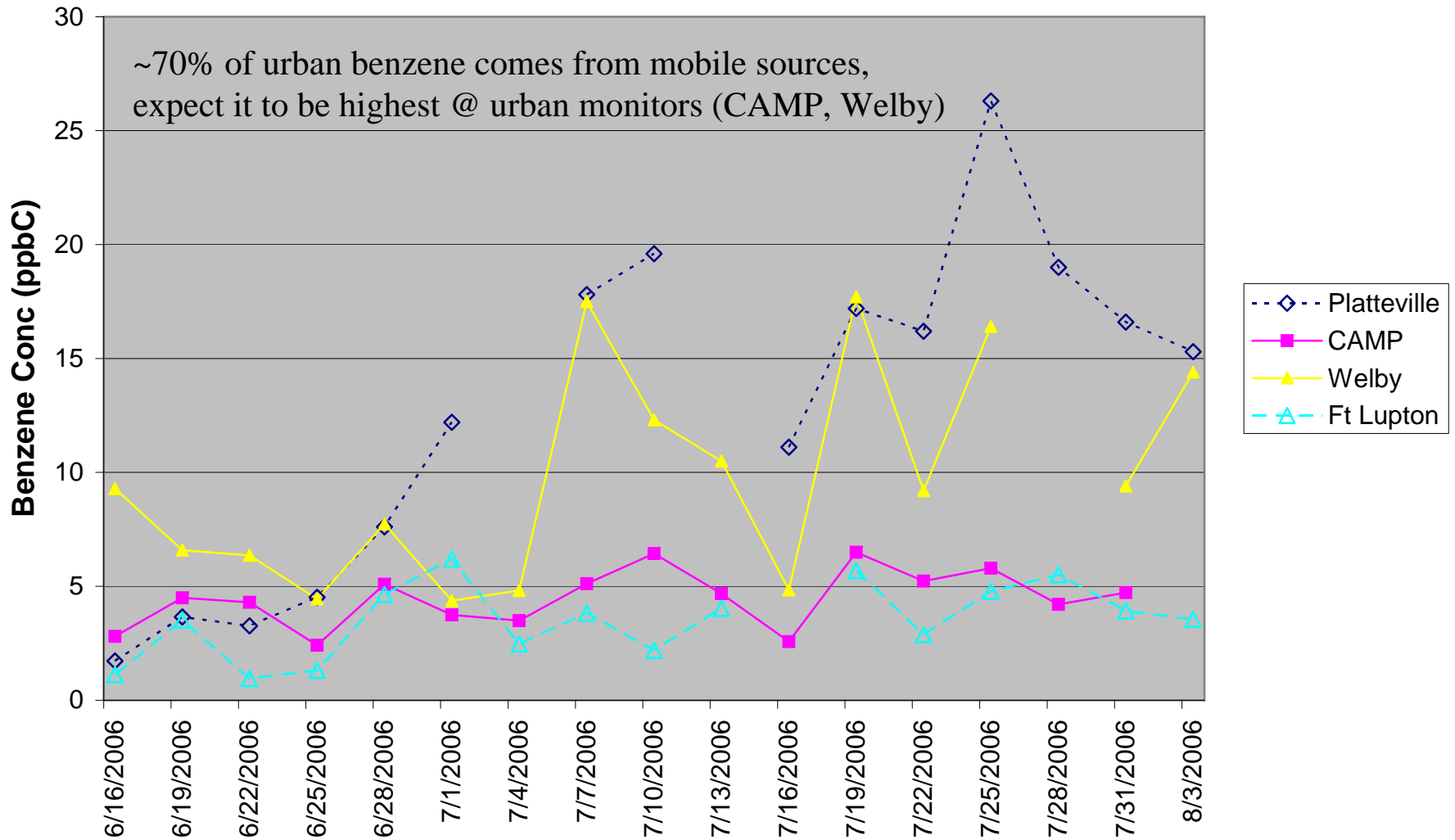
Friday December 14, 2007

Overview

- Measured SNMOC concentrations in N Front Range and ozone formation potential
 - Denver, Commerce City, Platteville, Ft Lupton
- Discrepancies in emissions inventories from well completions
- Additional control strategies are cost-effective

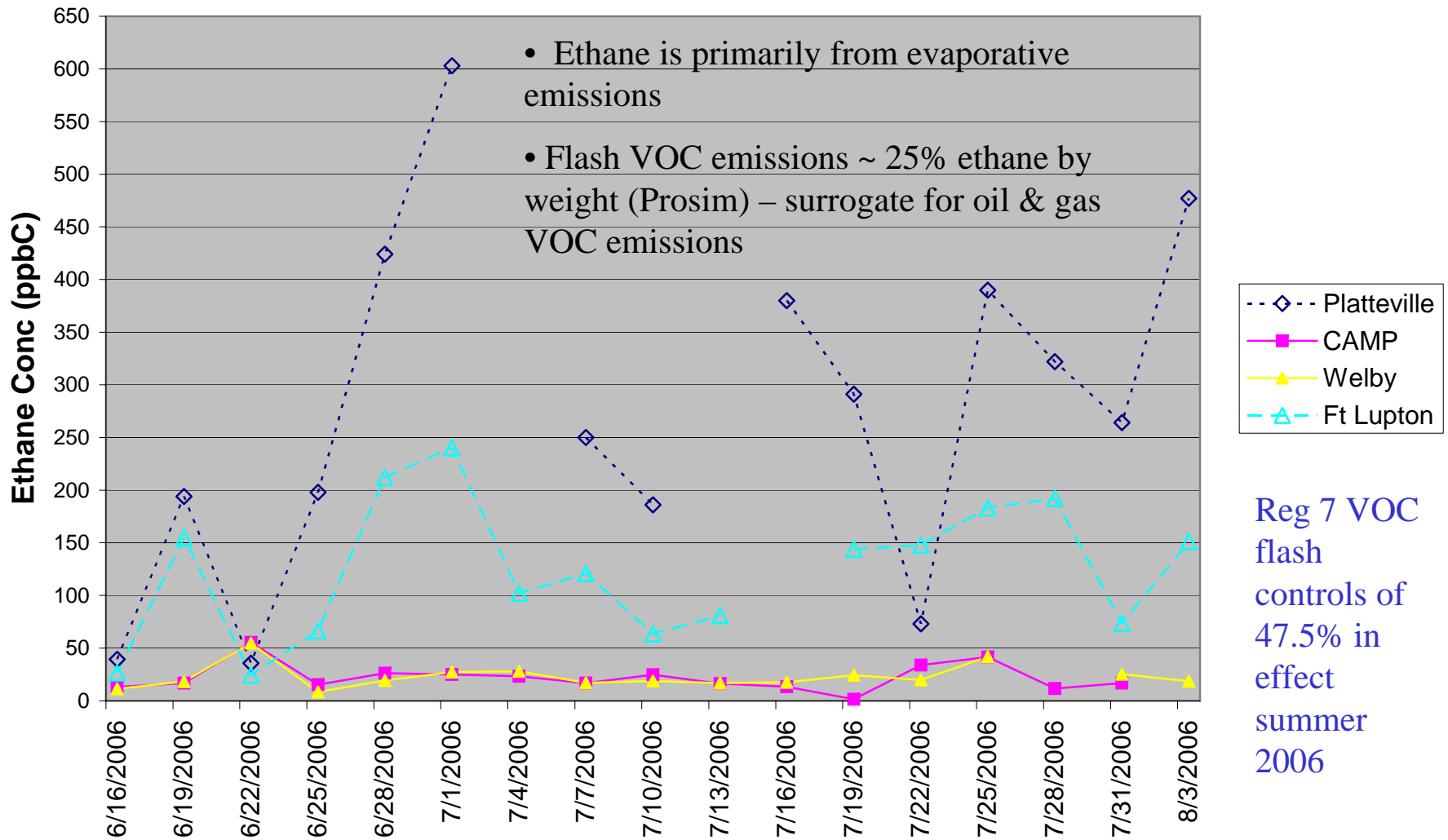
What Does Monitored Data Indicate?

2006 6-9am Benzene (ppbC) (1 ppbV = 6 ppbC)



What Does Monitored Data Indicate (2)?

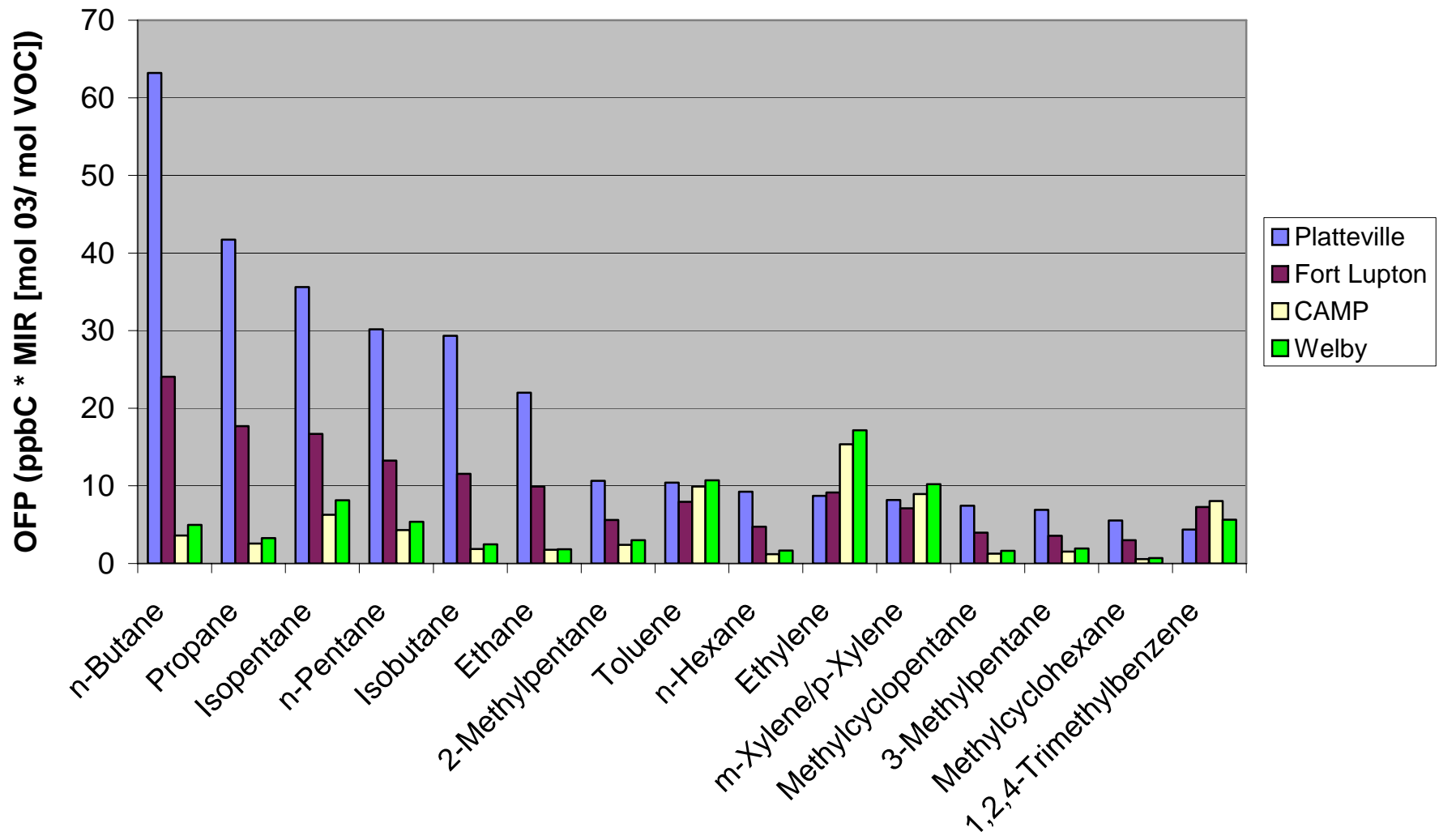
2006 6-9am Ethane (ppbC) (1 ppbV = 2 ppbC)



Ozone Forming Potential of Speciated VOCs

Maximum Ozone Formation Potential (OFP) of SNMOCs

Based on Jun – Jul 2006 6-9am SNMOC concentrations



Huge Uncertainty in Emissions Inventory Pertaining to Completions and Other Processes

- WRAP Phase I Study indicated well completions are a significant source of VOC emissions.
- Factor of 13 difference between industry's latest estimate (3.2tpd) and APCD (42tpd).
- Every variable utilized by COGA was derived from either an assumption or from an insufficient sample set.
- Complete lack of sufficient empirical data
- Assumption * Assumption * Assumption
= UNCERTAINTY!!!

Voluntary Measures Should Be Complimented with a Reporting Element

- Source Transparency is a Must!
- Needed to Assess Effectiveness of Voluntary Measures
- Are We Really Reducing VOCs from Current Levels or Continuing Business As Usual?
- Operators Should Record and Annually Report on a per Flowback Basis:
 - Gas Generated (scf), HC content (Btu) and Emissions (lbs)
 - Parameters Currently Measured in Field, but not Recorded

The Path Forward

1. Green Completions

- **972 wells completed just in 2006.**
- 90% reduction in VOCs from well completions through green completions, flaring, or other means.
- Data indicates completions may release 42 tons of VOCs/day (more or less) = **15,300 tons/year.**
- Limited data so far, need to gather more.
- Cost-effectiveness: experience indicates \$9.00 return for every \$1.00 spent on green completions is possible.
- Green in more than one way!

Capturing Leaking Money

2. Leak Inspection and Maintenance

- Very simple goal: reducing VOC leaks at gas processing plants and compressor stations.
- Leaks also release methane.
- Reducing leaks saves money.
- Leaks can account for 60% of VOC emissions at processing plants/compressor stations.
- Use of infrared camera enables detection, repair.
- Potential for paybacks within a year, millions in savings.



Cost-Effective Emission Standards

3. Processing and production standards

- 98% VOC reduction from all new and modified dehydrators; 90% from all existing.
- NO_x, CO, and VOCs limits for compressor engines.

Maximum Engine Horsepower	Compliance Date	NO _x g/hp-hr	CO g/hp-hr	NMHC g/hp-hr
25-500 hp	January 1, 2009	2.0	4.0	1.0
	January 1, 2011	1.0	2.0	0.7
Greater than 500 hp	July 1, 2008	2.0	4.0	1.0
	July 1, 2010	1.0	2.0	0.7

- Compressor engine VOC leak reductions; also reduce methane losses and yield a savings.
- Engines can leak thousands of dollars in methane annually that can be saved through better maintenance.
- 90% reduction in NO_x from drill rig engines.

Capturing Vented VOCs and Methane

4. Flaring and venting standards

- 98% reduction in casing head VOCs.
- 98% reduction in VOCs from pneumatics. Large pumps release as much as 85 tons of VOCs/year.
- 98% reduction in VOCs from all new storage tanks and vessels.
- 95% systemwide reduction in VOCs from storage tanks and vessels.
- No venting from any equipment at larger sources.
- Vapor recovery unit can recover vented VOCs and methane, pay itself back within months at a return of over 100%. **In use already!**

Thank You

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