

Air Quality and Greenhouse Gas Research Programs (at UT) relevant to the Natural Gas Sector

David Allen

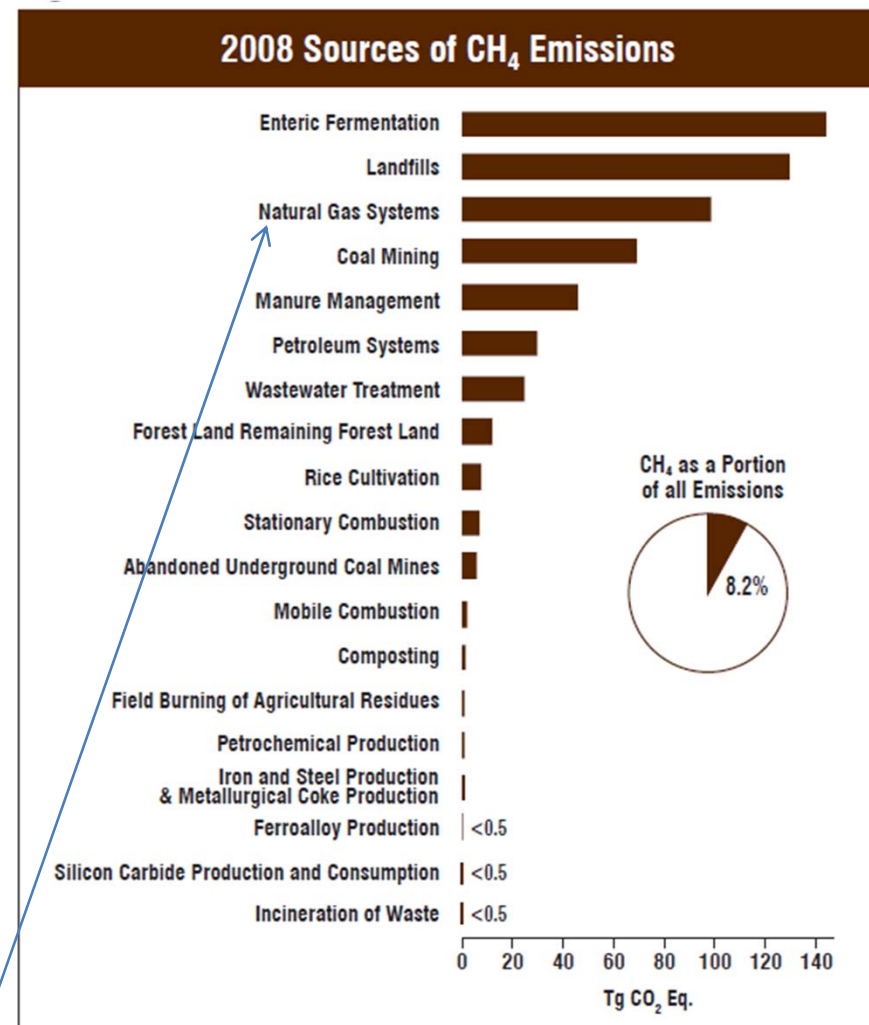
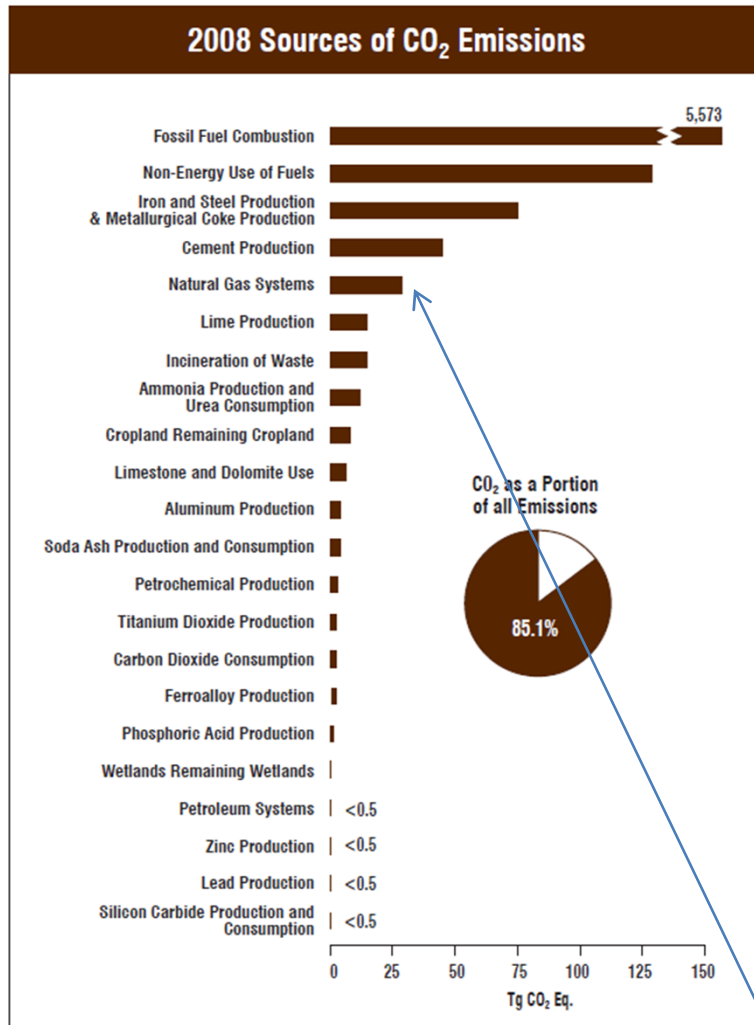
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Greenhouse gases



National greenhouse gas inventory (US EPA)



Natural Gas Systems



Greenhouse gas emissions from the natural gas sector

- Increased use of natural gas, replacing other fossil fuels, reduces life cycle greenhouse gas emissions
- According to the national greenhouse gas inventory, natural gas system emissions of methane and carbon dioxide reduced by roughly 30% since 1990
- Nevertheless, there is an increased focus on greenhouse gas emissions from natural gas systems
 - Subpart W reporting required beginning in 2011
 - Emission measurements or emission factors?



Measurements or emission factors?

- Mandatory Reporting of Greenhouse Gases Rule
 - On November 8, 2010, Administrator Jackson signed a rule that finalizes reporting requirements for the petroleum and natural gas industry under 40 CFR Part 98, the regulatory framework for the Greenhouse Gas (GHG) Reporting Program.
 - Extensive new measurement requirements (e.g., for compressor venting)
 - Measurements or emission factors?



Emission estimates are only as good as emission factors -

Table 2: Comparison of Process Emissions from each Segment of the Natural Gas and Petroleum Industries

Segment Name	U.S. GHG Inventory ¹ Estimate for Year 2006 (MMTCO ₂ e)	Revised Estimate for Year 2006 (MMTCO ₂ e)
Production ²	90.2	198.0
Processing	35.9	39.5
Transmission and Storage	48.4	52.6
Distribution	27.3	27.3

1. U.S. EPA (2008) *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006*.

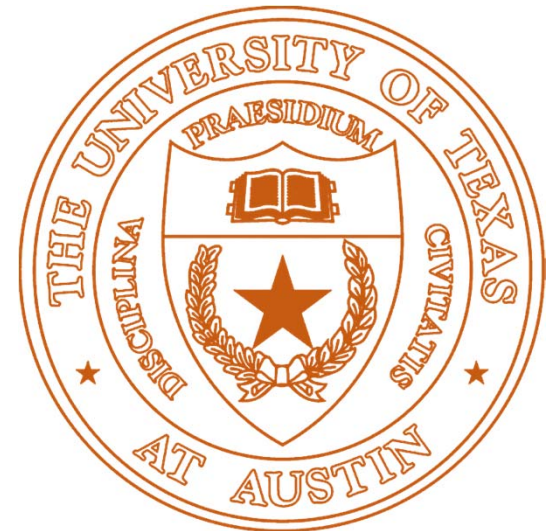
2. Production includes equipment leaks and vented emissions from both the natural gas and petroleum sectors' onshore and offshore facilities.

Source: GREENHOUSE GAS EMISSIONS REPORTING FROM THE PETROLEUM AND NATURAL GAS INDUSTRY : BACKGROUND TECHNICAL SUPPORT DOCUMENT ;



Greenhouse Gas Emission Factor Development Project

<http://www.utexas.edu/research/ceer/GHG/>



Overall Project Goals

(from initial project report in 2008)

- Review emission factor development since 1995 GRI/EPA study
- Develop sampling plans for emission factors believed to have greatest uncertainties
- Update emission factors

Industry Segment	Emissions Sources	Timing of Work
Production	Well Clean Ups	Phase 2
	Completion Flaring	Phase 2
	Well Workovers	Phase 2
	Pipeline Leaks	Phase 2
Processing	Recip compressors (fugitive)	Phase 1
	Cent. Compressors (fugitive)	Phase 1
Transmission and Storage	Recip. Compressors (fugitive)	Phase 1
	Pneumatic Devices (vent)	Phase 1
	Cent. Compressor (fugitive)	Phase 1
	Cent. Compress (storage)	Phase 1
	Meter and Regulating Stations	Phase 1
Distribution	Residential customer meters	Phase 2
	Mains-plastic	Phase 2
	Services-plastic	Phase 2



Overall Project Goals

(from initial project report in 2008)

- Update emission factors for
 - **Production:** Well clean-ups, completion flaring, well workovers, pipelines leaks
 - **Processing:** fugitive emissions from reciprocating and centrifugal compressors
 - **Transmission and Storage:** *fugitive emissions from reciprocating and centrifugal compressors*, pneumatic devices, and M&R stations
 - **Distribution:** Residential customer meters, plastic mains and services



Pilot sampling program

Ownership	Date Visited	Description	IR screening?	Hi Flow on component leaks	Vent Pipes Measured
Co #1	11/3/09 TX	6 Recips (1965)	√	√	√
Co #1	11/4/09 TX	5 Recips ('92 – '09)	√	√	√
Co #1	11/3/09 TX	3 Centrif (1982)	√	√	√
Co #2	2/23/10 W. TX	15 Recips	√	√	√
Co #2	2/24/10 NM	8 Recips (1950's)	√	√	√



Findings from pilot measurements

Comparison to GRI/EPA Data

Comparison Basis: The GRI/EPA data is from Table 4-15 of "Methane Emissions from the Natural Gas Industry: Volume 8".

- Emission factors for valves, flanges, other miscellaneous components lower than GRI/EPA emission factors (small part of overall emissions)
- Increases the emission factor for packing vents for reciprocating compressors
- Reduces or raises the emission factor for blowdown vents for compressors depending on operating practices (dominates overall emissions)
- Not all vents are accessible, or safely accessible
- Some vents are joined, data interpretation is difficult.

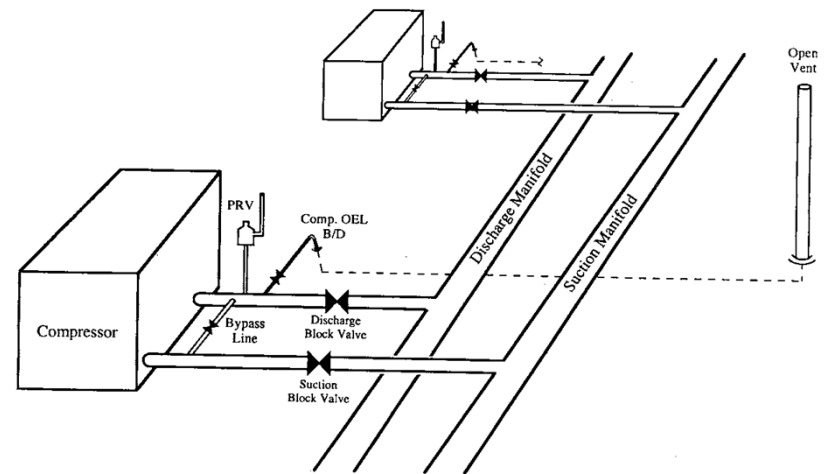


Figure 4-1. Illustration of Compressor Blowdown Valve Arrangement



Current Path

- With Remaining Budget:
 - Focus on vents only and add as many compressor stations as possible
 - Measure 12-15 compressor stations, update emission factors
 - Survey INGAA members for company practices on compressor operating practices that affect leak rate
 - Produce and publish updated compressor emission factors.



Air quality in regions with extensive
natural gas exploration:

The Texas Air Quality Research Program



AQRP

Air Quality Research Program

<http://aqrp.ceer.utexas.edu/>

The Texas Commission on Environmental Quality has selected the University of Texas at Austin to administer the Texas Air Quality Research Program.

The goal of the Program is to develop scientific information needed by the State as it responds to new, more stringent air quality standards, particularly the anticipated new ozone standards



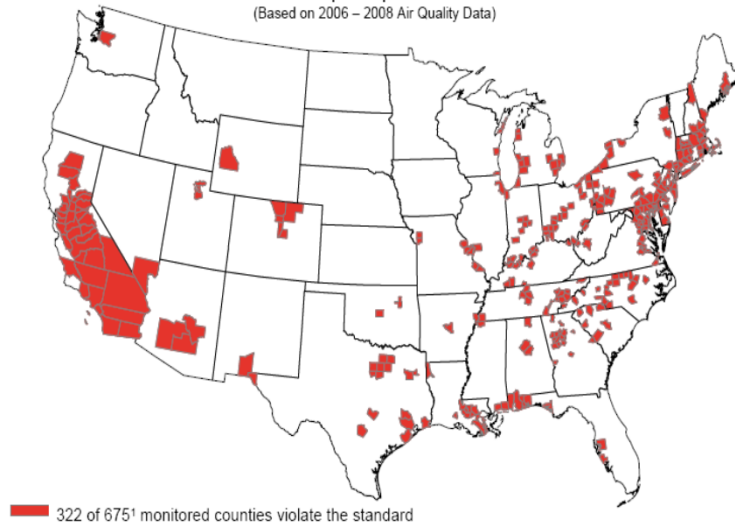
Recent Revisions to Ozone NAAQS and implications for regional transport

- **March 2008:**
 - EPA significantly strengthened the “primary” NAAQS for ground-level ozone 8-hour average concentrations from 0.08 to 0.075 ppm.
- **January 2010:**
 - EPA proposed to strengthen the NAAQS for ozone within the range of 0.060-0.070 ppm.
 - EPA will issue final standards and attainment designations by October 31, 2010.
 - Once nonattainment designations take effect, state and local governments have three years to develop implementation plans.
- **December 2013:**
 - SIPs are due to the EPA.
- **2014 to 2031:**
 - States are required to meet the primary standard, with deadlines depending on the severity of the problem.



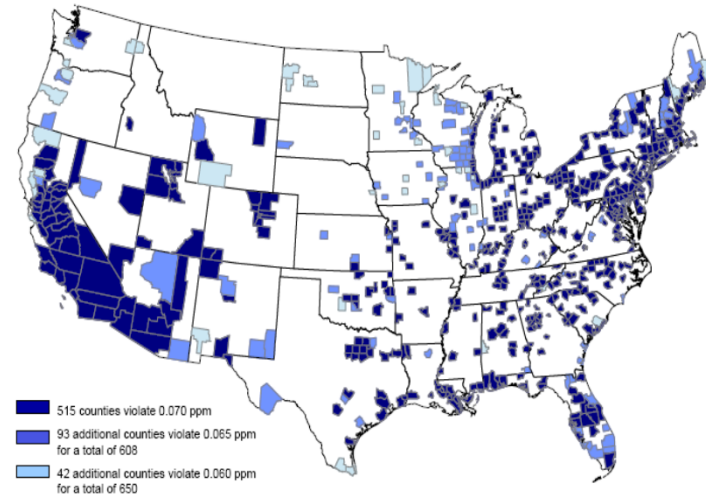
Impacts of Elevated Ozone Levels Related to Changes in NAAQS for Ozone

Counties With Monitors Violating the March 2008 Ground-Level Ozone Standards
0.075 parts per million
(Based on 2006 – 2008 Air Quality Data)



Counties With Monitors Violating Proposed Primary 8-hour Ground-level Ozone Standards
0.060 - 0.070 parts per million
(Based on 2006 – 2008 Air Quality Data)

EPA will not designate areas as nonattainment on these data, but likely on 2008 – 2010 data which are expected to show improved air quality.

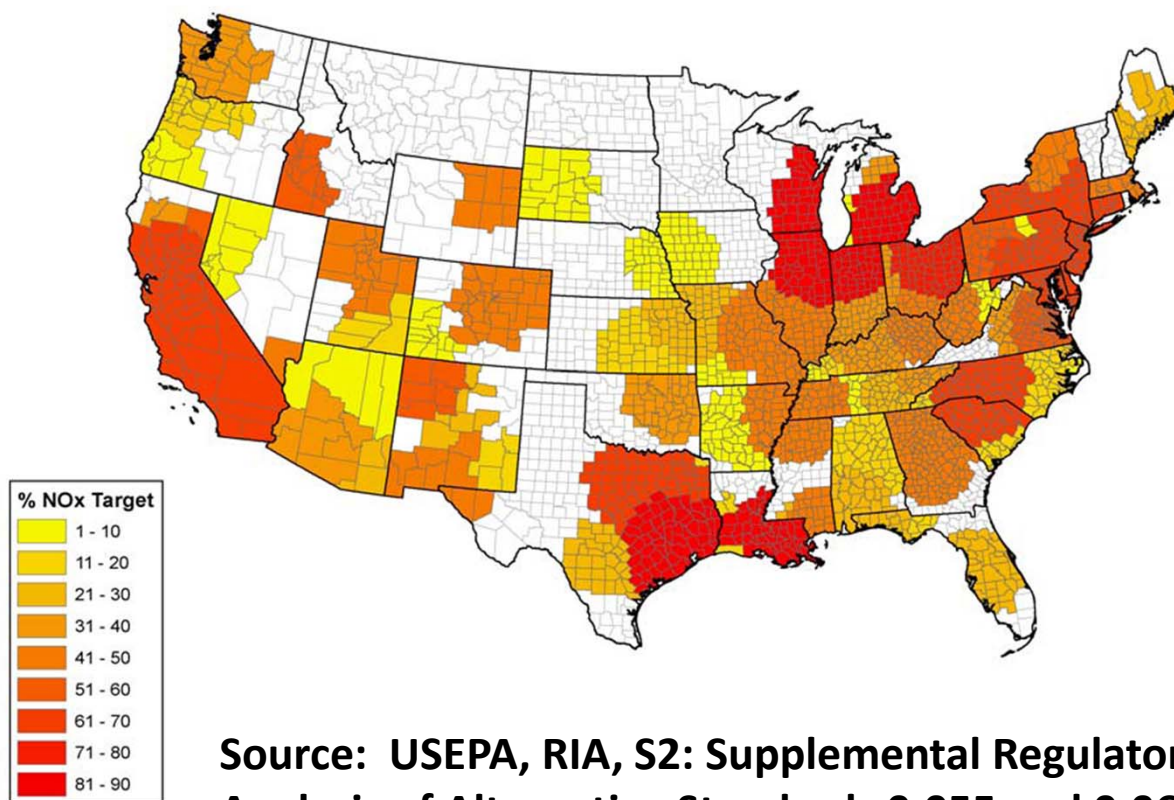


- 85 counties in non-attainment of the previous 0.08 ppm NAAQS.
- 322 non-attainment counties under the previously proposed 0.075 ppm NAAQS.



Figure S2.2: Map of Extrapolated Cost Counties for the 0.060 ppm Alternate Standard and Estimated Percentage NO_x Controls Needed to Meet that Standard in 2020

Extrapolated Cost Counties for 060 Standard



Source: USEPA, RIA, S2: Supplemental Regulatory Impact Analysis of Alternative Standards 0.055 and 0.060 ppm for the Ozone NAAQS Reconsideration,

http://www.epa.gov/ttn/ecas/regdata/RIAs/s2-supplemental_analysis-060&05_55_11-5-09.pdf



AQRP

Air Quality Research Program

<http://aqrp.ceer.utexas.edu/>

Approximately \$4.9 million in funding has been allocated to the Texas Air Quality Research Program to improve scientific understanding of emissions, atmospheric chemistry, and the global, continental, and regional movement of air pollutants. The Program will also improve the models used to evaluate the effectiveness of emission reductions



Projects approved for funding

- Projects fell into broad categories:
 - Dallas-Fort Worth measurement campaign
 - Measurements of emissions from industrial flares
 - Improvements to air quality models
 - Improvements to emission estimates
- Proposals were received from multiple Texas Universities, national laboratories, and environmental consulting firms/Universities outside of Texas with specialized expertise

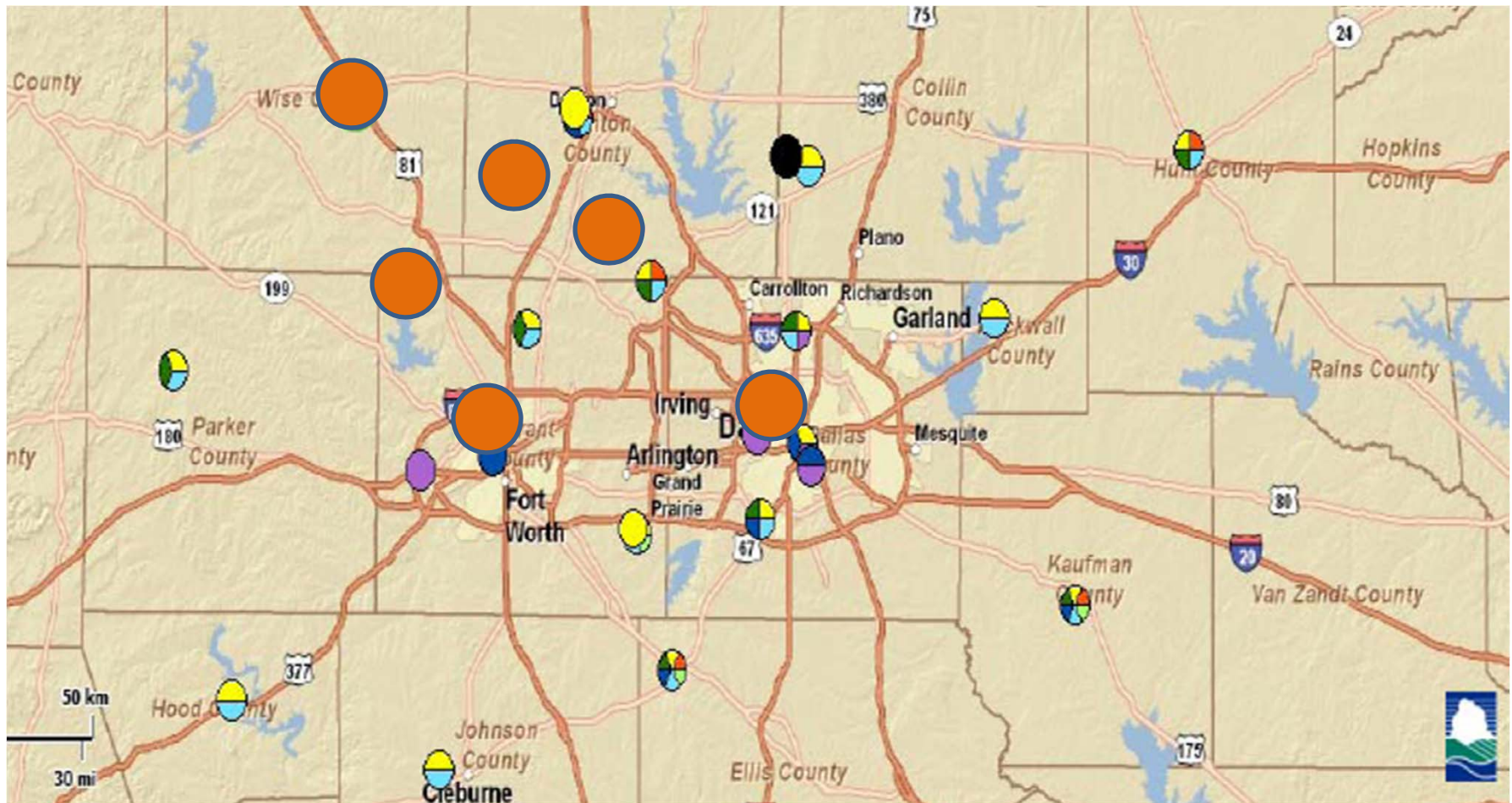


DFW Measurement Campaign: Projects approved for funding

- New measurements at one or more ground sites
- Aircraft measurements
- Ground sampling capable of making “flux” measurements (more directly related to emissions than concentrations)



TCEQ sites with enhanced sampling already underway



Summary

- AQRP actively engaged in air quality research in regions with extensive gas exploration
- AQRP will seek stakeholder input on research priorities for current and next bienium; suggestions for communication mechanisms welcome

