



SMU School of Engineering

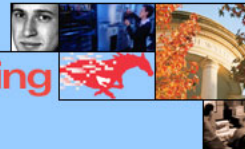


Environmental  
& Civil Engineering  
Engineering and Beyond



SMU School of Engineering

Environmental & Civil Engineering



### Al Armendariz

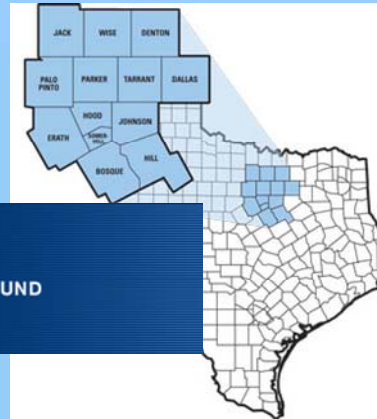
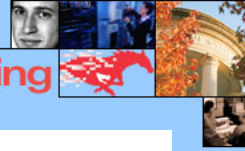
- School of Engineering at SMU
- former engineering consultant with Radian International
  - *natural gas pipeline utilities*
  - *gas research institute*
  - *pulp and paper*

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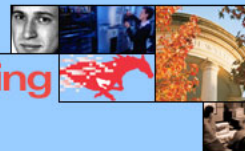
ENVIRONMENTAL DEFENSE FUND  
finding the ways that work

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## Objectives

- Construct an emissions inventory of air pollutant emissions for oil and gas activity in the Barnett Shale region
- Identify cost-effective pollution control alternatives

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### What this work includes:

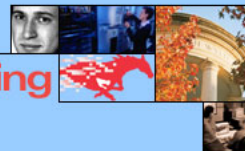
- air pollutants
- Barnett Shale region

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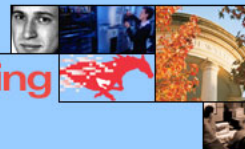
### What this work DOES NOT deal with:

- water use
- water disposal
- noise
- right of ways and eminent domain
- moratoriums
- safety
- royalties

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**The emission estimates in this report are not specific to the City of Fort Worth. They are applicable to the Barnett Shale region as a whole.**



**Important notes:**

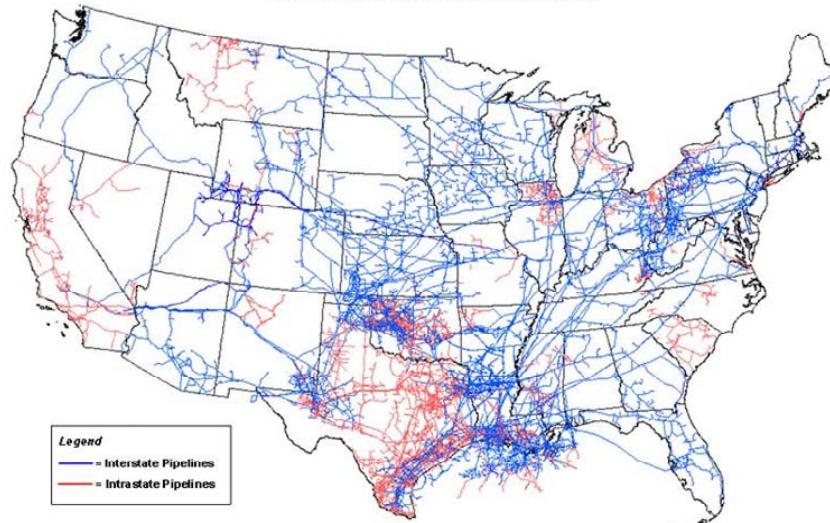
- some air pollutants are important to those in the immediate vicinity
  - *air toxics*
- other air pollutants are important at the regional, national, or global scale
  - *ozone and particulate matter forming (NOx and VOC)*
  - *climate changing compounds (CO2 and methane)*



## OUTLINE

- Objectives
- Trends in Oil and Gas Production
- Sources of Emissions
- Pollutants
- Emission Estimates
- Reducing Emissions

U.S. Natural Gas Pipeline Network

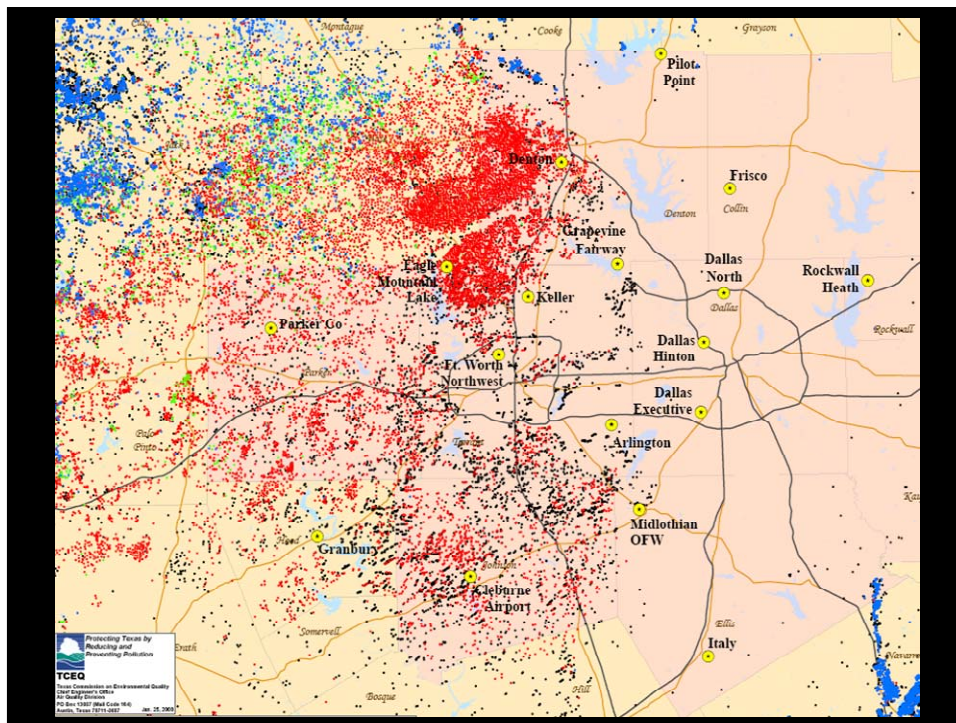


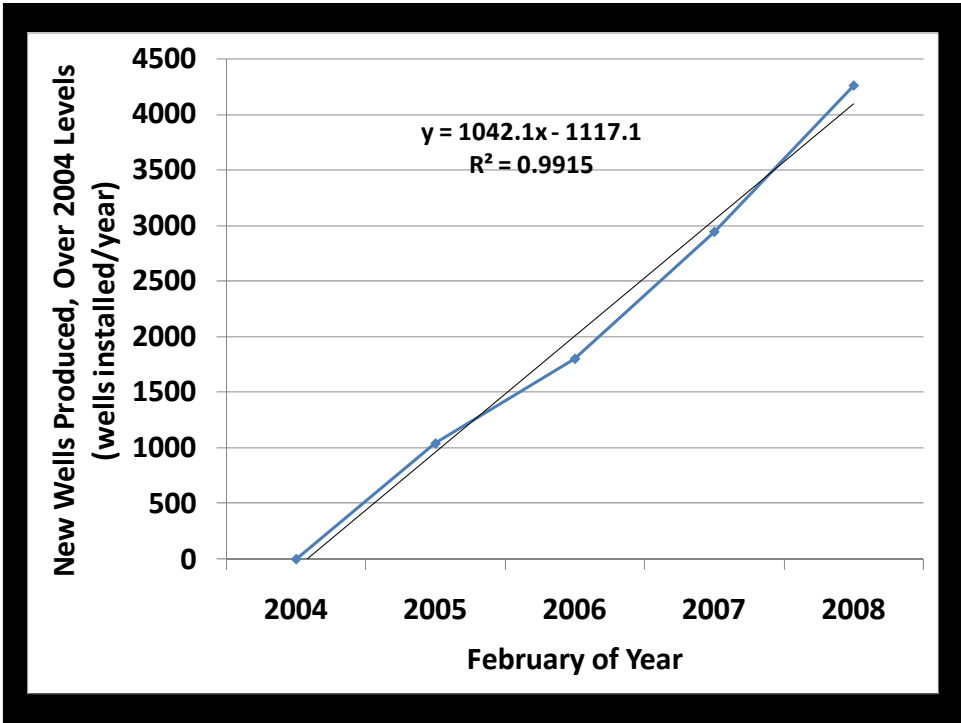
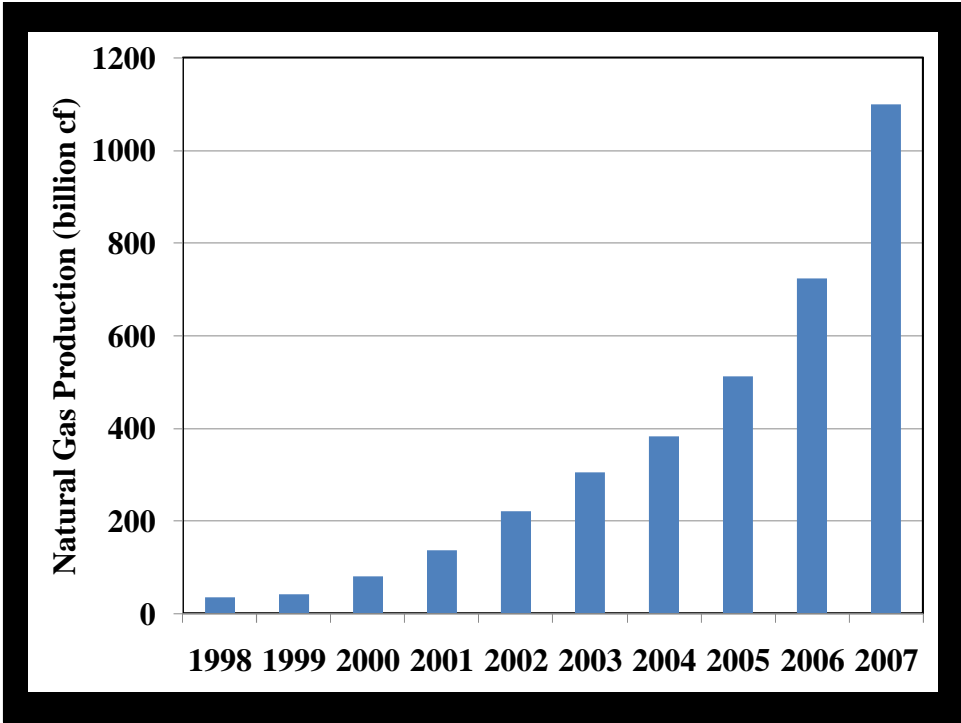
Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System



## Benefits of Oil/Gas Production

- less greenhouse gas emissions per BTU of energy produced compared to coal
- less mercury and sulfur emissions per BTU of energy produced compared to coal
- critical feedstock to fertilizer production and chemical production



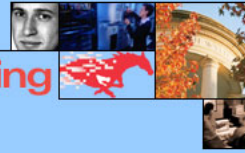


County	Gas Production (MCF)	Condensate (BBL)	Casinghead Gas (MCF)	Oil Production (BBL)
Johnson	282,545,748	28,046	0	0
Tarrant	246,257,349	35,834	0	0
Wise	181,577,163	674,607	6,705,809	393,250
Denton	168,020,626	454,096	934,932	52,363
Parker	80,356,792	344,634	729,472	11,099
Hood	32,726,694	225,244	40,271	526
Jack	16,986,319	139,009	2,471,113	634,348
Palo Pinto	12,447,321	78,498	1,082,030	152,685
Stephens	11,149,910	56,183	3,244,894	2,276,637
Hill	7,191,823	148	0	0
Erath	4,930,753	11,437	65,425	5,073
Eastland	4,129,761	130,386	754,774	259,937
Somervell	4,018,269	6,317	0	0
Ellis	1,715,821	0	17,797	10
Comanche	560,733	1,584	52,546	7,055
Cooke	352,012	11,745	2,880,571	2,045,505
Montague	261,734	11,501	3,585,404	1,677,303
Clay	261,324	12,046	350,706	611,671
Hamilton	162,060	224	0	237
Bosque	135,116	59	0	0
Kaufman	0	0	3,002	61,963

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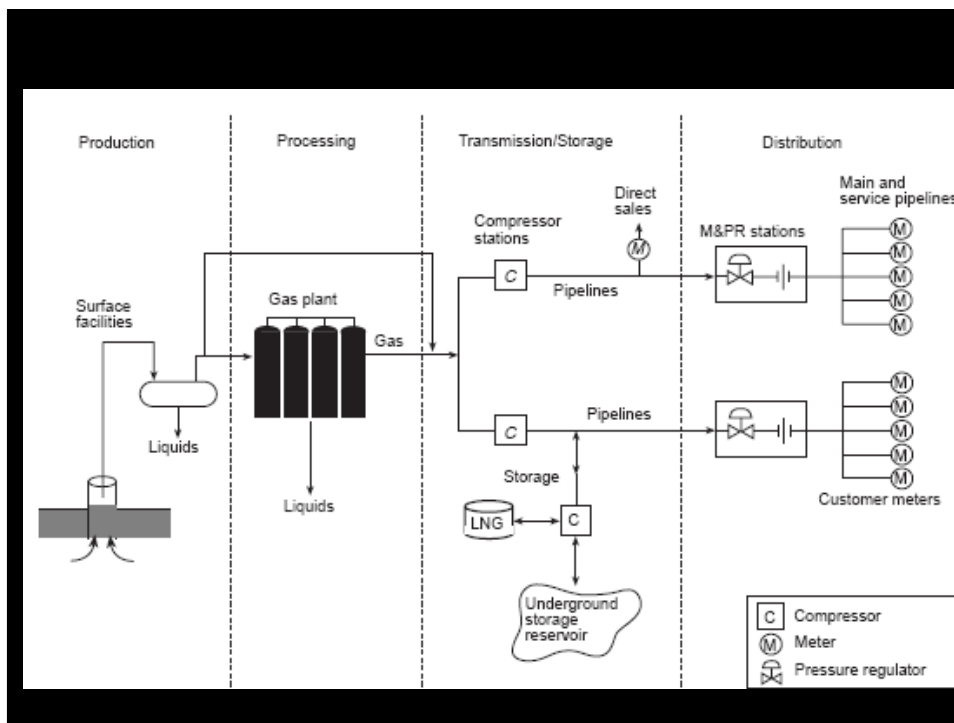
top 3 gas producers:  
Johnson, Tarrant, Wise

top 3 condensate producers:  
Wise, Denton, Parker



## Sources Studied

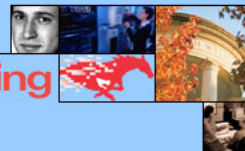
- Point Sources
  - Compressor Engines
  - Condensate/Oil Tanks
- Fugitive and Intermittent Emissions
  - Well Drilling and Well Completions
  - Wellhead Fugitives
  - Gas Processing Fugitives
  - Transmission Fugitives





### Sources Not Yet Studied (time & effort)

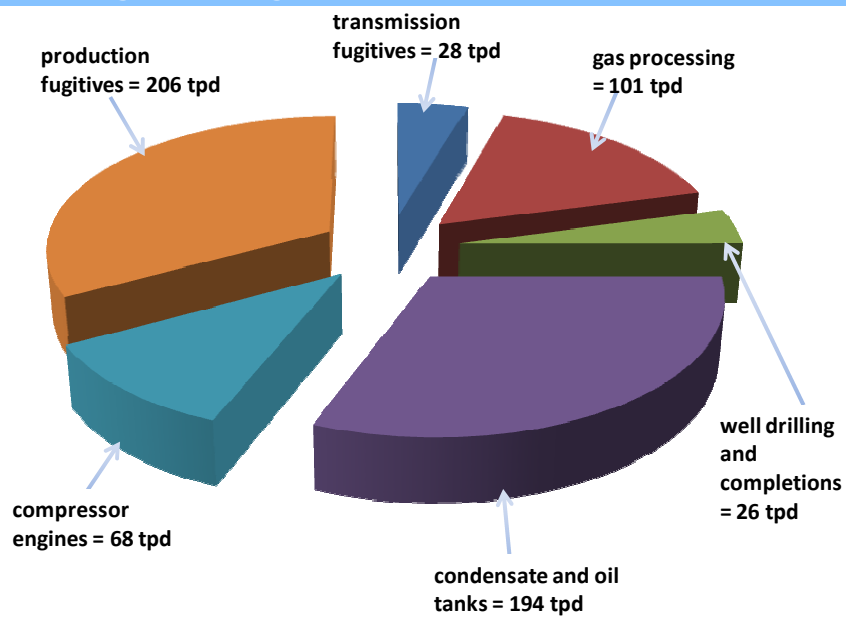
- Truck Traffic
- Frac Pump Engines
- Chemical/Additive Tanks
- Water Tanks (oils)
- Water Treatment/Recycling Facilities (oils)
- Well Injection Pump Engines



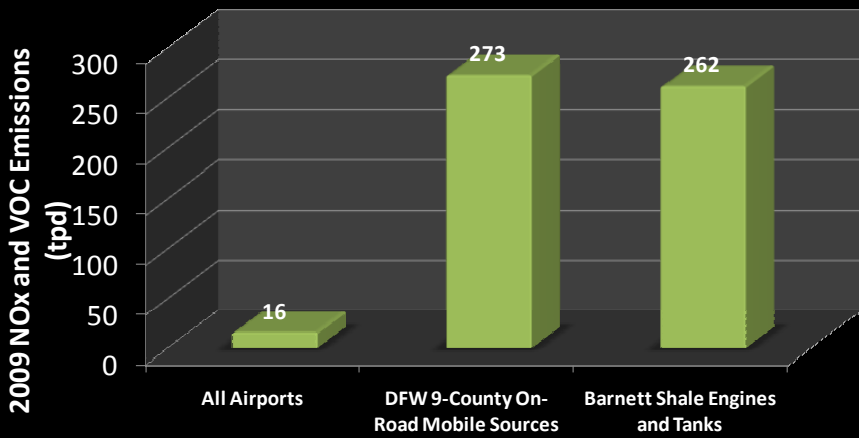
### Pollutants from Oil/Gas Production

- Greenhouse Gases
  - *carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>)*
- Particulate and Ozone Smog Pollutants
  - *volatile organic compounds*
  - *nitrogen oxides*
- Hazardous Air Pollutants
  - *benzene*
  - *formaldehyde*

### smog forming emissions (NOx + VOC)

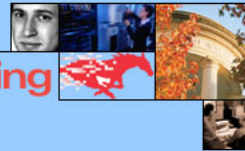


### smog forming emissions (NOx + VOC)





- Air Toxics
  - 33 tons/day
  
- Climate Changing Emissions
  - 30,000 tons/day

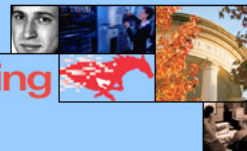


- Reducing Emissions
  - *replacing compressor engines with electric motors*
  - *equipping oil and condensate tanks with vapor recovery units (VRUs)*
  - *eliminate all venting of wells during well completions*
  - *green completions*



### ■ Reducing Emissions

- *“NSPS-type” leak detection schedule on all well fittings and components, metering stations, processing plants, tanks*
- *eliminate all high-bleed pneumatic devices, replace with air-actuated devices*
- *all water trucks, construction machinery, other mobile sources must meet TERP standards*



### ■ Emissions Inventory – Version 2.0

- *Industry-funded emissions inventory*
- *all emission sources included*
- *stakeholder advisory board for methods, contractor selection, etc*
  - *Industry*
  - *City of Fort Worth*
  - *County Governments*
  - *EPA*
  - *EDF*
  - *TCU/SMU/UTA*

Ozone Levels for Tuesday August 14, 2007 17-18:00 CDT

