

# Two for One Special: Targeting Pollutants that Both Cause Local Air Pollution Problems and Contribute to Climate Change

Ellen Baum, Senior Scientist  
For Spring Meeting of National  
Association of Clean Air Agencies



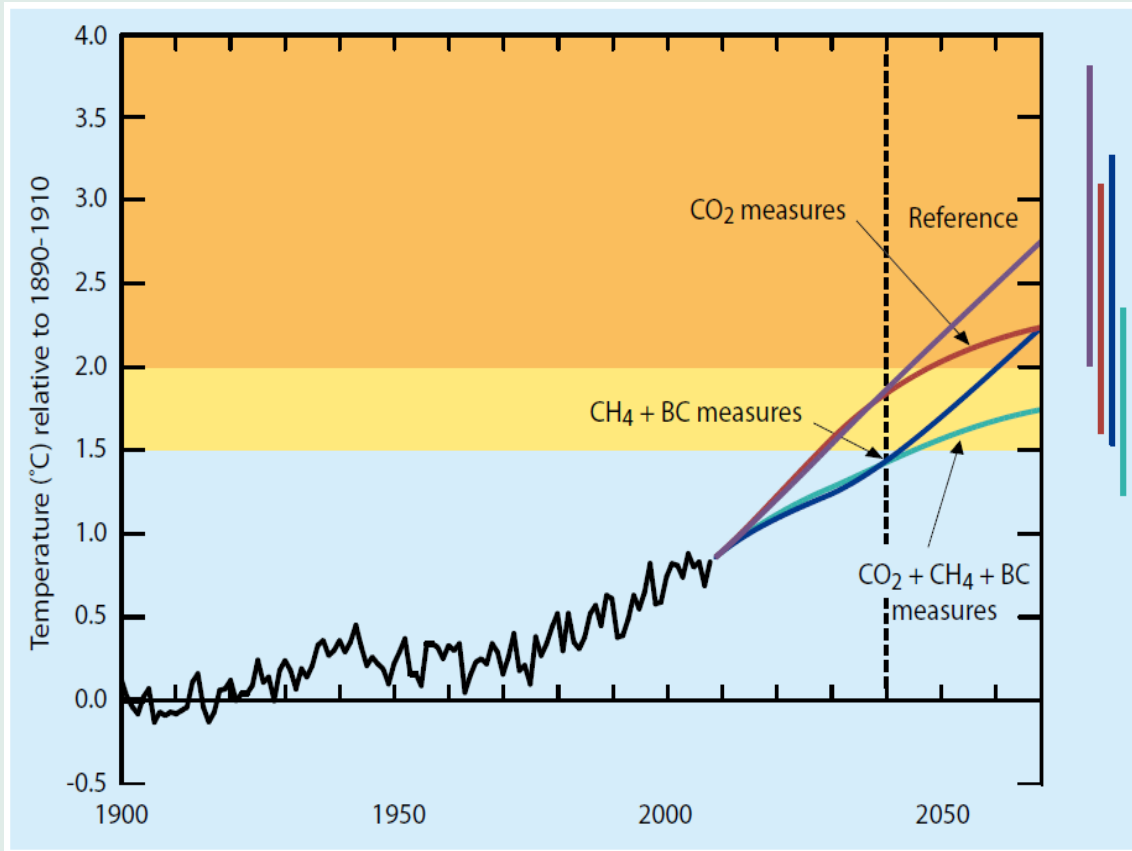
May 7, 2012, revised

# Air and Climate Pollution

- Black carbon, tropospheric ozone, and methane – short-lived climate pollutants or SLCPs – are pollutants that have a negative impact on both climate and local, regional and global air quality.\*
- Targeting emission reduction strategies can provide near-term climate mitigation and health and environmental benefits.
- Two talks today – Overview and methane talk by me and a Black Carbon presentation by Erika Sasser.

\*This talk does not cover pollutants that benefit temperature by cooling but have a negative impact on air quality, namely sulfur dioxide, which quickly converts to sulfate.

# Why short-lived climate pollutants matter for climate? UNEP results



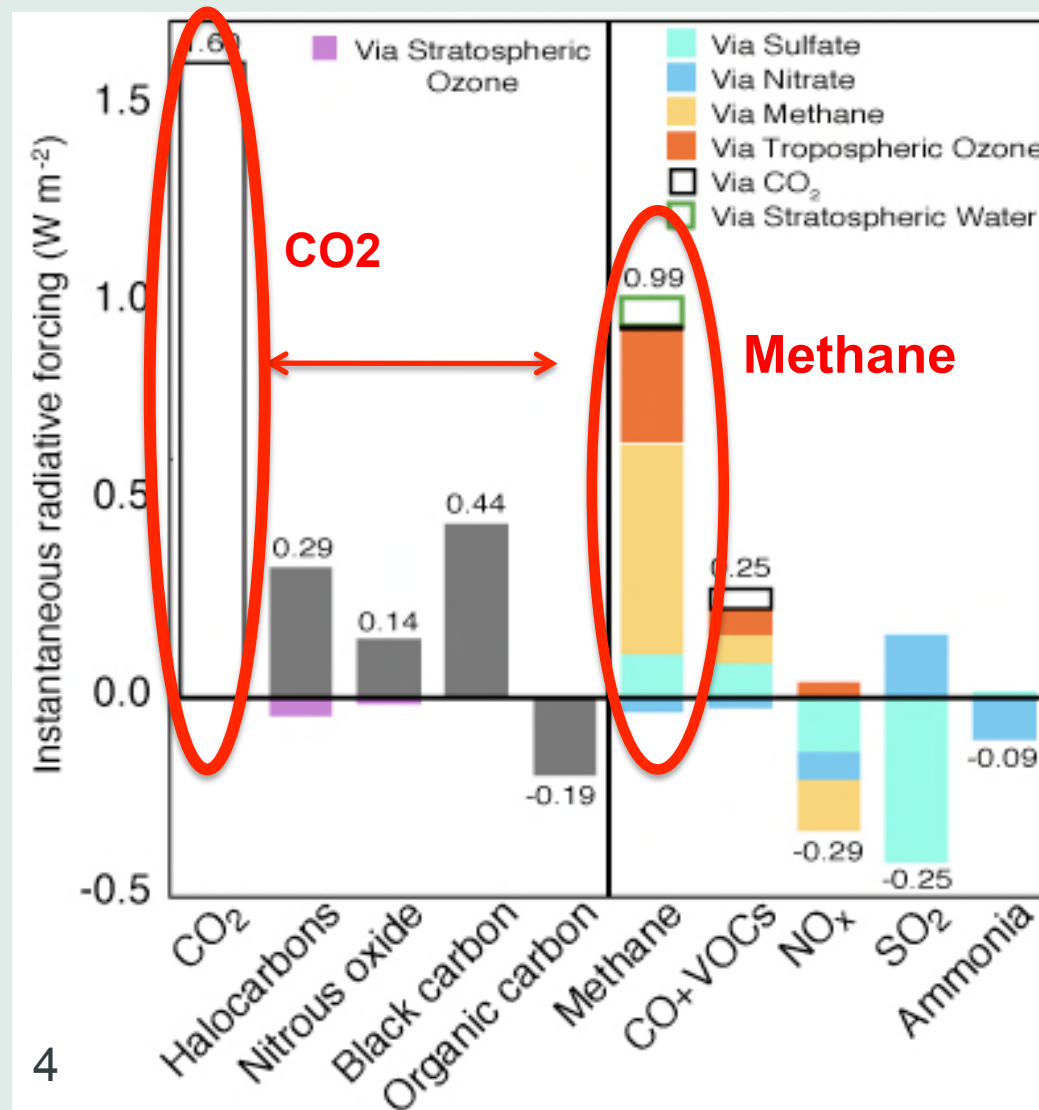
Reductions of SLCPs could slow the pace of global warming over the next few decades.

This modeling exercise, which is the basis of the recently announced Climate and Clean Air Coalition, looked at 16 aggressive, global application of methane and black carbon reduction measures.

Results: Only reductions in CO<sub>2</sub> and these SLCPs would allow us to constrain temperature below 2° from preindustrial in this century.

From UNEP, Summary for Decision Makers, 2011

# Methane is a major warmer: methane and its breakdown products are warming the climate about half as much as carbon dioxide

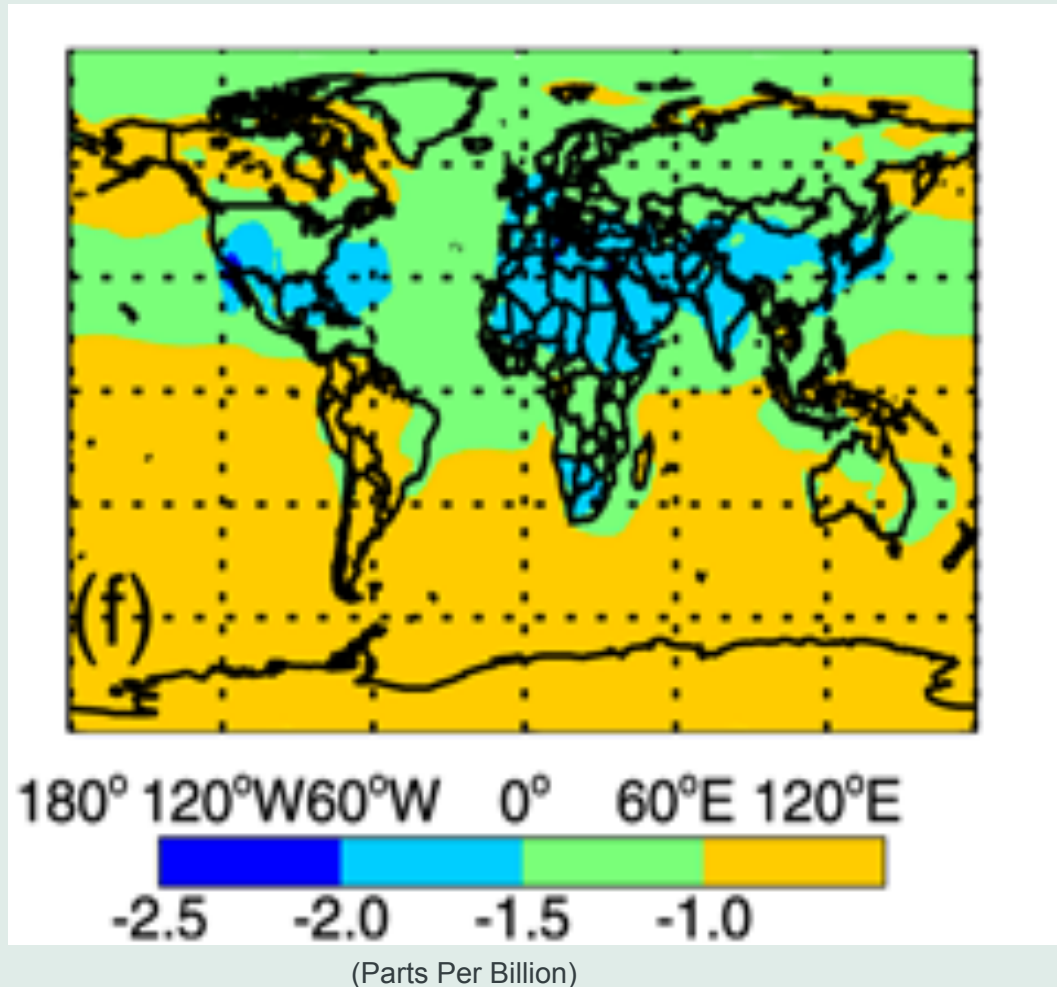


Source: Shindell et al., Science, 2009

# Methane is a precursor of background global tropospheric ozone

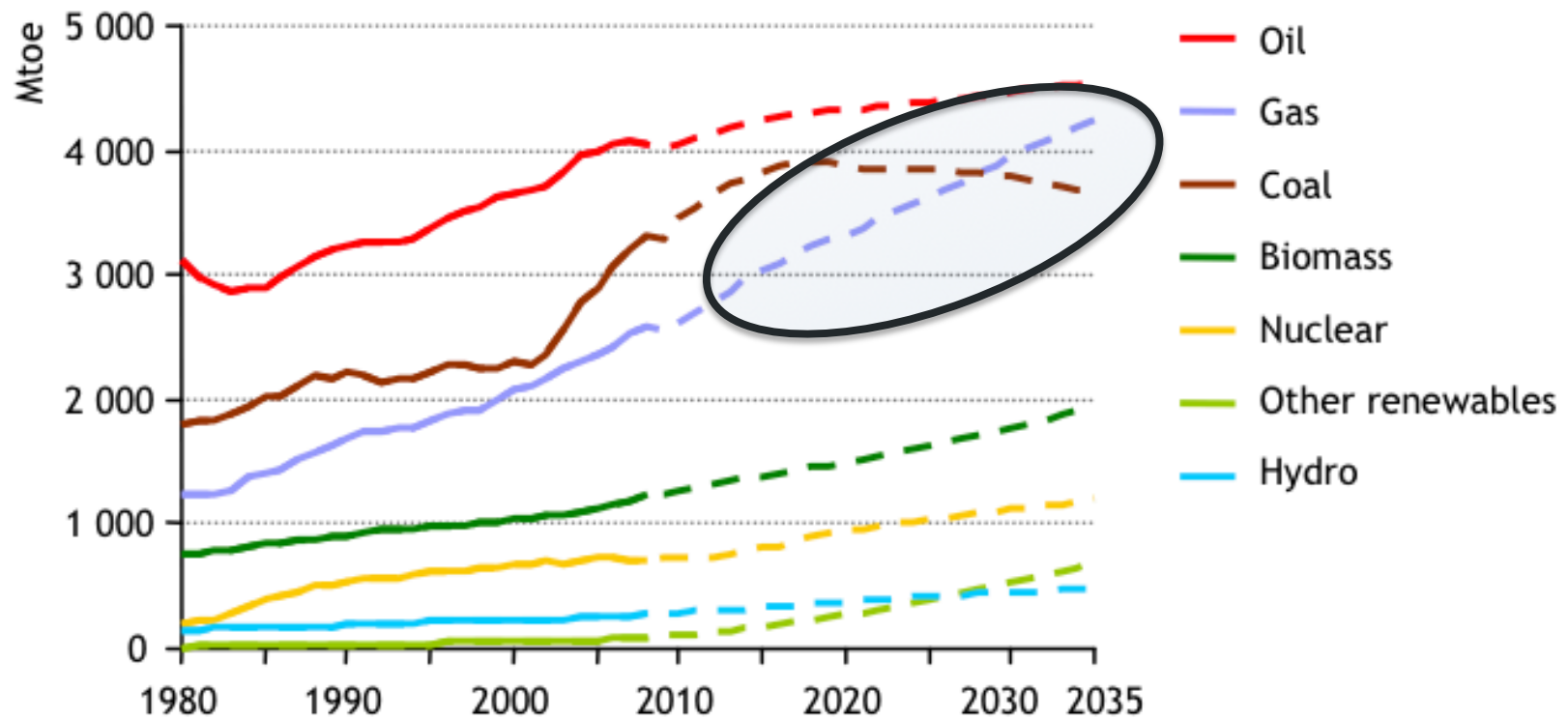
- A 31% decrease in global anthropogenic CH<sub>4</sub> emissions results in a decrease in up to 2 ppm global daily maximum **8-hour ozone levels**.
- This is background ozone, which is the most climate-relevant ozone

*Fiore, et. al. JGR, 2008*



# Where does methane come from? Natural gas is major source, and world reliance on gas is expected to grow

Figure 1.1 ▶ World primary energy demand by fuel in the GAS Scenario

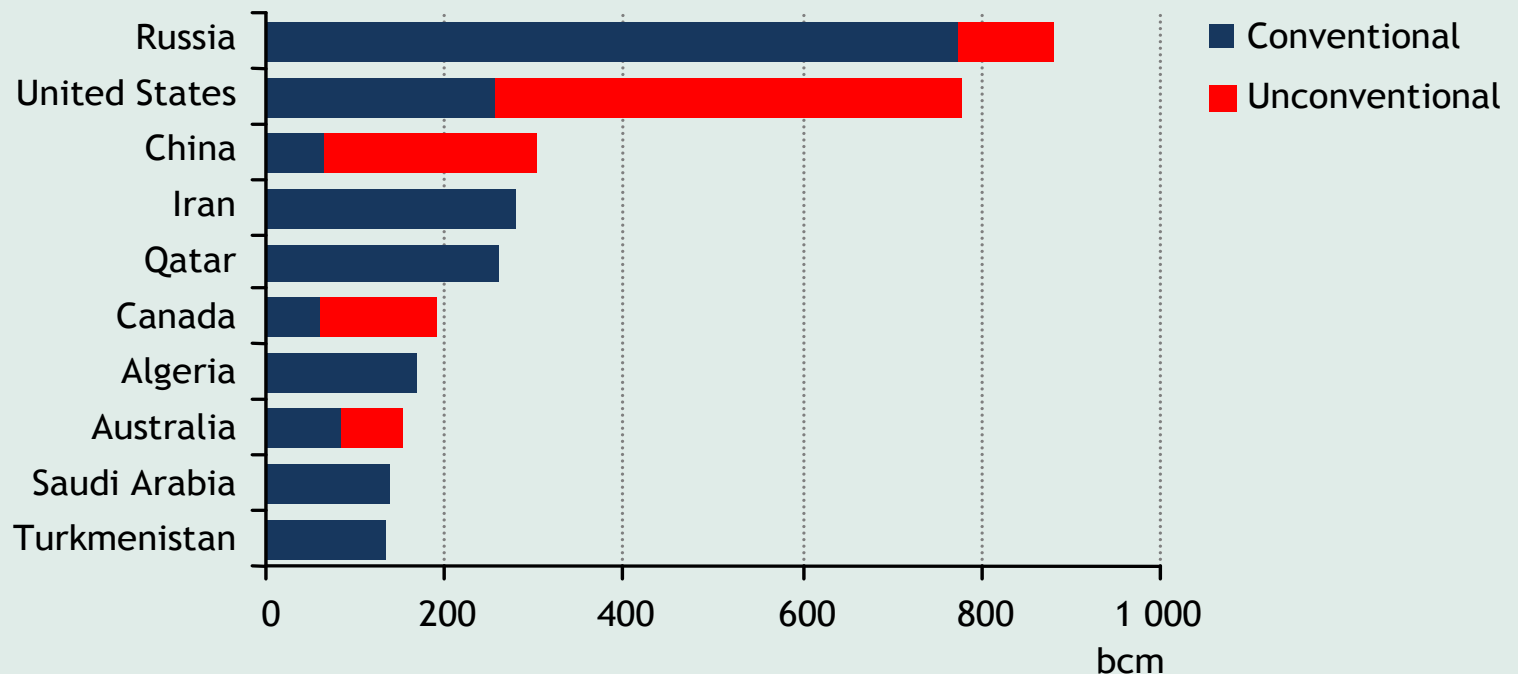


Source: IEA, "The Golden Age of Gas" (2011)

# With unconventional gas sources – shale gas – US is expected to be the 2<sup>nd</sup> largest producer of natural gas

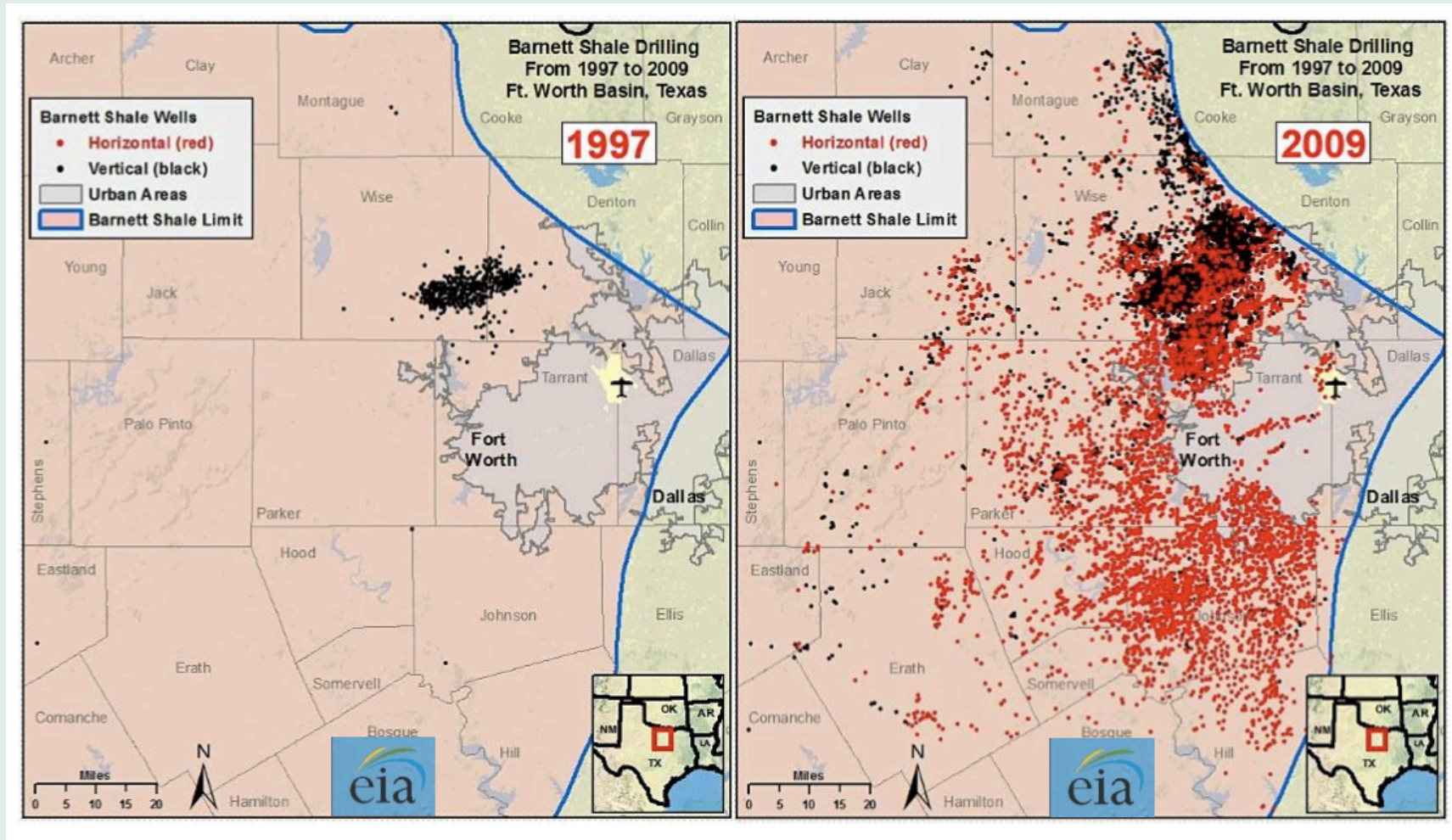
Improperly managed gas development and transmission releases a lot of methane and other pollutants

**Figure 1.8** ▶ Largest gas producers by type in the GAS scenario, 2035





# Some states have already seen enormous expansion: Dallas Fort Worth Counties

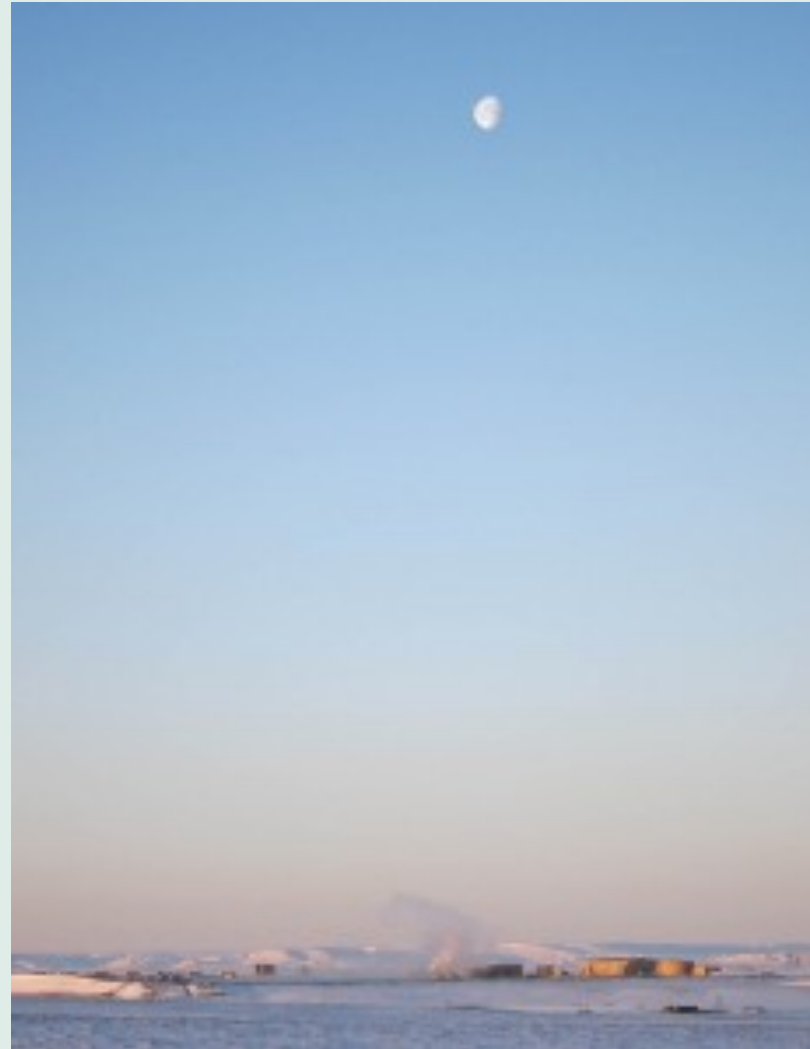


O&G sector in the DFW area likely has greater smog forming emissions than motor vehicles in the five DFW counties.

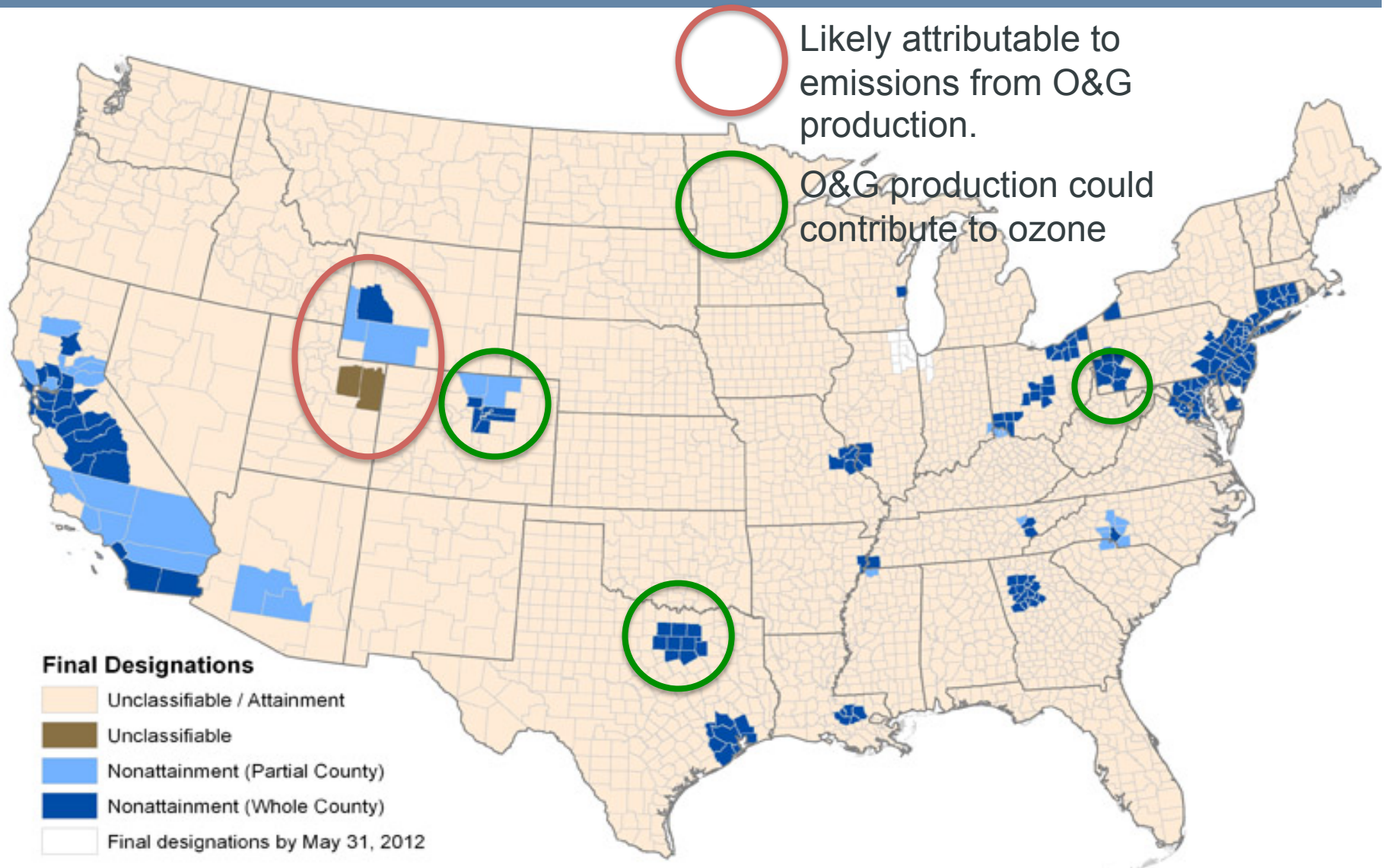


# Gas operations in US associated with incidence of localized high winter ozone

- Ground-level ozone exceeded federal health standards in northeast Utah's Uintah Basin on 26 days between January and March 2012.
- In Wyoming, after two years of clean winter air in the Upper Green River Basin, there were 13 days between January and March 2012 when ozone levels exceeded standard, including a March 2 ozone reading higher than the worst ozone levels recorded last year in Los Angeles.



# April 30, 2012 ozone non-attainment designations



# Potential unconventional gas emission points



Surface off-gas

Well emissions-venting, flaring and flowback emissions at completion

Condensate tank emissions

Drilling and fracking equipment

Trucks

Compressor Stations (offsite)

Emissions include methane, VOC, NOx, PM, CO2, BC and toxics



# Emission points for natural gas systems: some easily understood and controllable, but not all

## Natural Gas Production & Processing

Cost effective: can reduced emissions >80%  
Cost effective: can reduce emissions >60%  
Cost effective can reduce emissions significantly  
Effectiveness of technologies unknown

Wells: Venting during well completion and well maintenance.

Flaring of gas from wells, dehydrators, separators, processing equipment; ranges from clean to dirty

Raw gas: methane (always); VOC (usually); hydrocarbons –HAPS (often), hydrogen sulfide (sometimes)

CO<sub>2</sub>  
CO, methane, & NOx (possibly quite large amounts)  
Toxic Organics  
BC/PM: not quantified, can be high

## Gas Transmission

Compressors on pipelines

Methane  
NOx, CO, VOC, CO<sub>2</sub>

Deliberate release of gas for operational purposes

## Gas Distribution

Leaks from unprotected steel mains and service lines

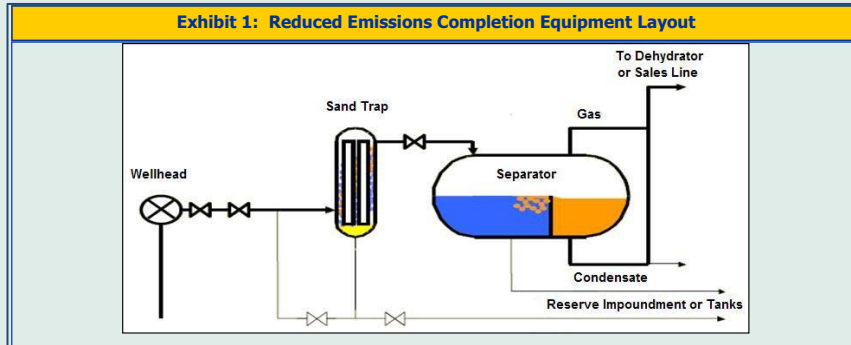
Methane, VOC

Methane, VOC

# Examples of low emissions gas drilling practices and technology



Zero bleed pneumatic valves

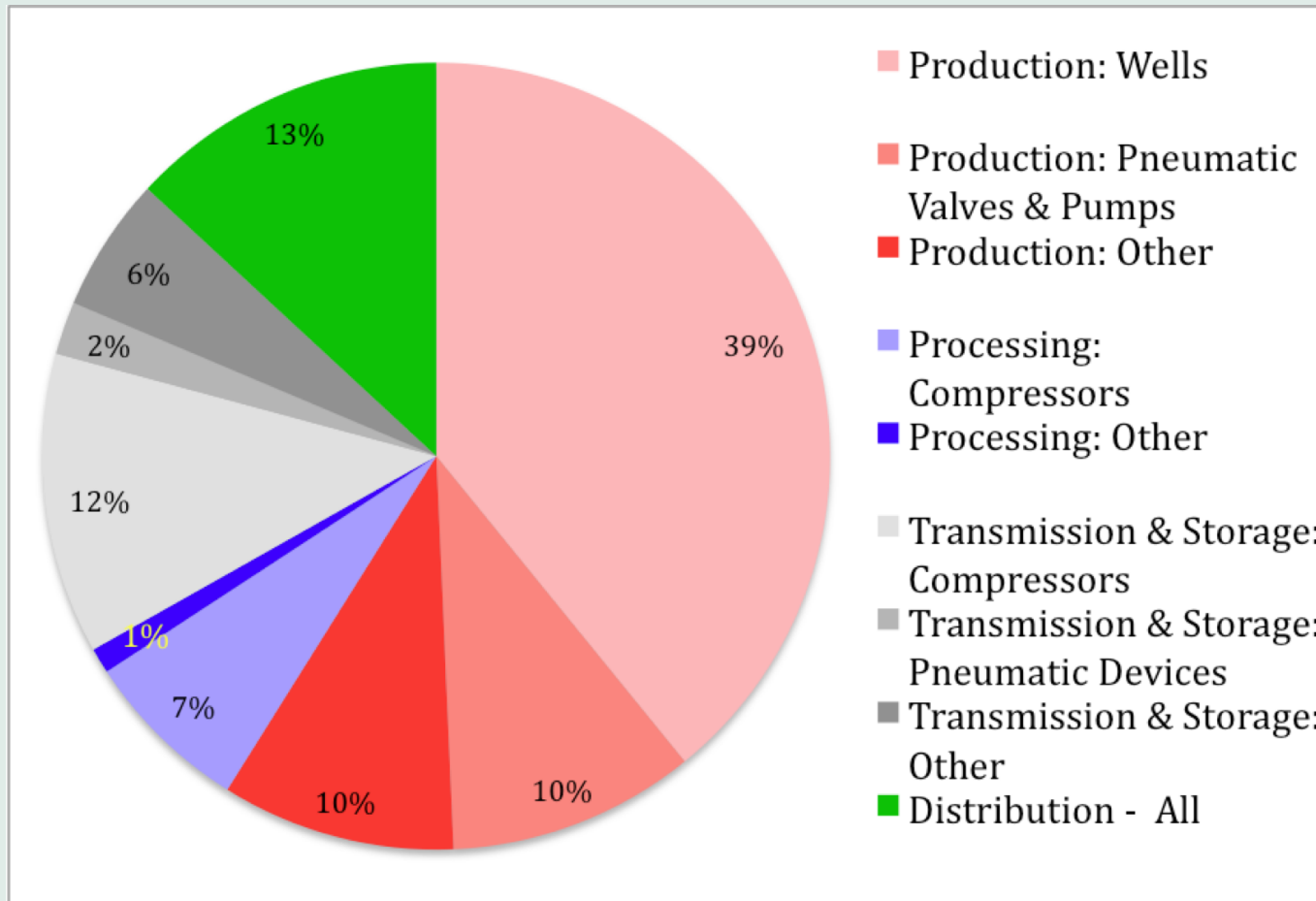


Leak detection and repair



Reduced emission completions  
—Green Completions

# Most methane venting in oil and gas production is estimated to come from the upstream production side





## April 17, 2012 U.S. Environmental Protection Agency issued regulations aimed at the Oil and Gas Industry

- The first federal air standards for natural gas wells that are hydraulically fractured, along with requirements for several other sources of pollution in the oil and gas industry that currently are not regulated at the federal level.
- Capturing natural gas when a fracked well is completed, beginning 2015 and until then requiring flaring and prohibiting venting.
- Eliminating leaks from pneumatic controllers.
- Reducing compressor leaks.
- Emission controls on storage tanks
- Tighter leak detection at processing plants.
- Replaced compressors and pneumatic controllers must be clean/modern technologies.

## What we'd still like to see

- Direct regulation of methane.
- Requirements for well clean up phase (removing water and other clogs in older wells).
- Addressing oil wells, either conventional or fracked.
- Better controls for compressors and pneumatic controllers
- Testing of equipment for leaks beyond the processing plants.
- Existing sources

## There are also state and city level regulations, which have shown that regulations do not appear to slow industry growth

- Wyoming regulations have been put in place 1997 – 2010
  - well completions, pneumatic controllers, pumps, glycol dehydrator, storage tanks, separators.
  - More stringent requirements apply in areas of intense development,
- Colorado first introduced regulations in 2004 -2009 covering
  - well completions, pneumatic devices , dehydrators and condensate tanks, NOx emissions from engines and in some basins processing plants.
- In both states, gas development has not slowed as a result of these rules. In fact, growth in the number of active rigs and the amount of gas withdrawn in these states has been faster than for the US as a whole.
- There are some city –based regulations in Fort Worth and Southlake, Texas

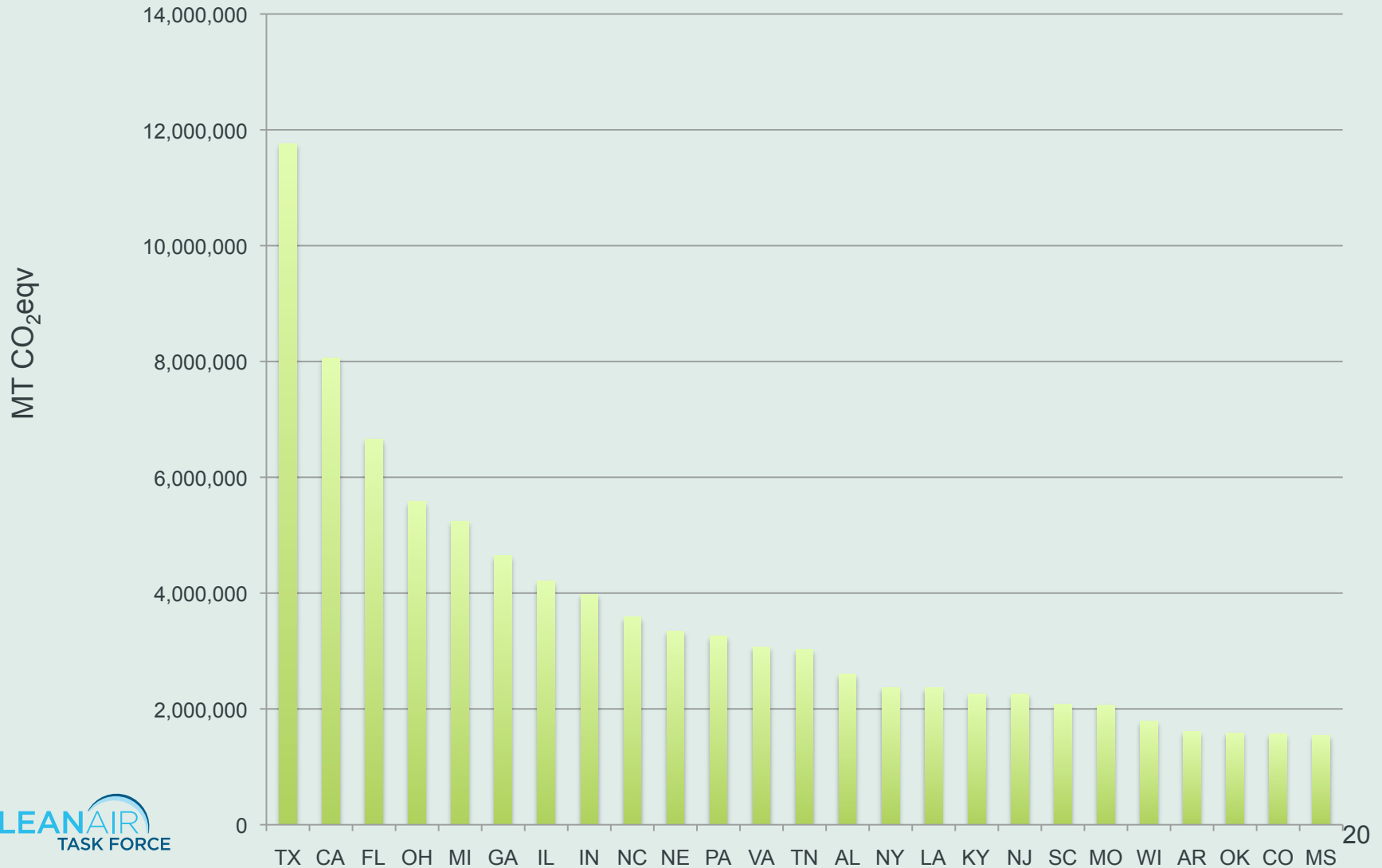
# Best Practices Initiatives – some examples

- ***Institute for Gas Drilling Excellence***. IGDE brings together five large natural gas developers in the Marcellus region with other stakeholders to develop strong environmental guidelines and best management practices standards for shale gas development in Pennsylvania, along with a rigorous third-party verification procedure.
- ***STRONGER***, endorsed by DOE's Secretary Chu's Shale Gas Panel, expects to improve state regulation of the oil and gas industry by producing a guideline document against which state regulations for the protection of air quality in oil and gas production can be reviewed and evaluated. This initiative recognizes that some state environmental protection agencies have much more protective water and air regulations for the O&G sector than others.
- **The Keystone Center**, is proposing a Dialogue on Shale Gas Development to ensure that existing best practices are agreed upon and implemented in a fully accountable manner.

# Landfill Methane

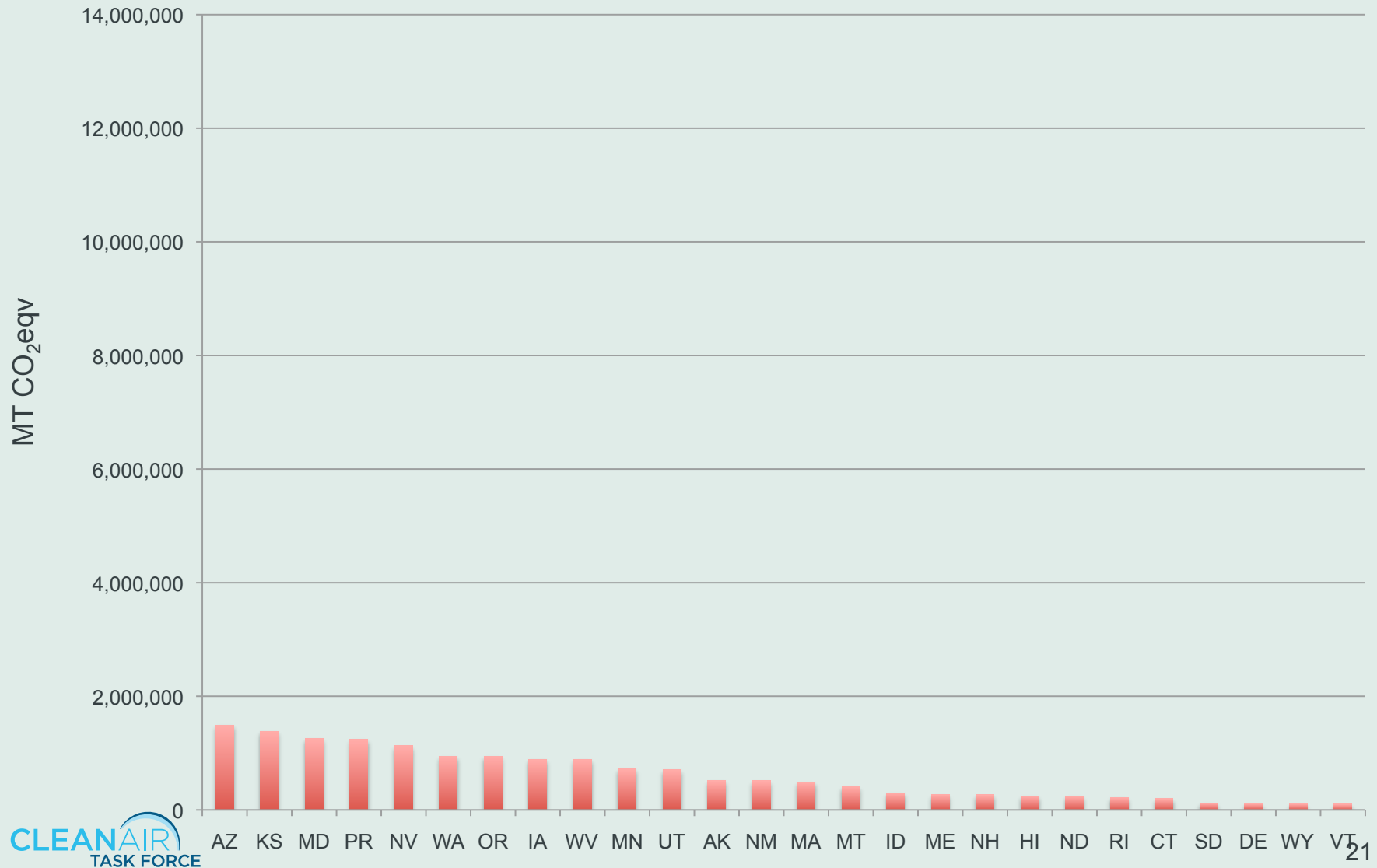
- In the US, the largest landfills are required to capture a portion of their methane emissions, although methane is not directly regulated. This means about half of US landfills are regulated.
- Landfills remain a large source of domestic emissions, and more stringent controls are necessary on the sources already covered by EPA regulations.
- We spent a little time looking at two EPA databases based on recent requirement of the Greenhouse Gas emissions requirements for large facilities to figure out just how large US landfill emissions are and whether emissions are coming from open or closed landfills and/or landfills with or without active collection systems.

# Landfill Methane Emissions--Top 25 States

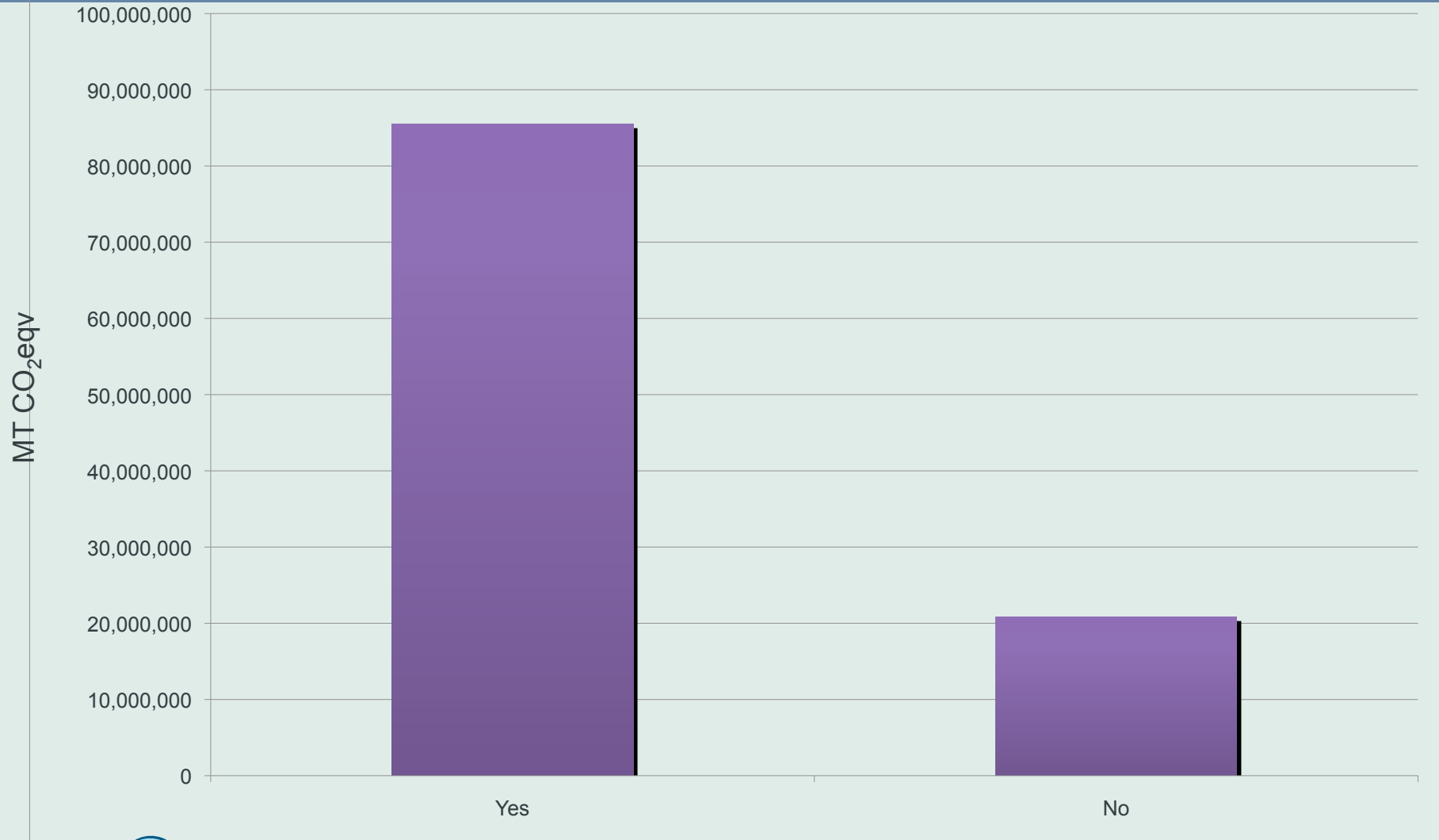




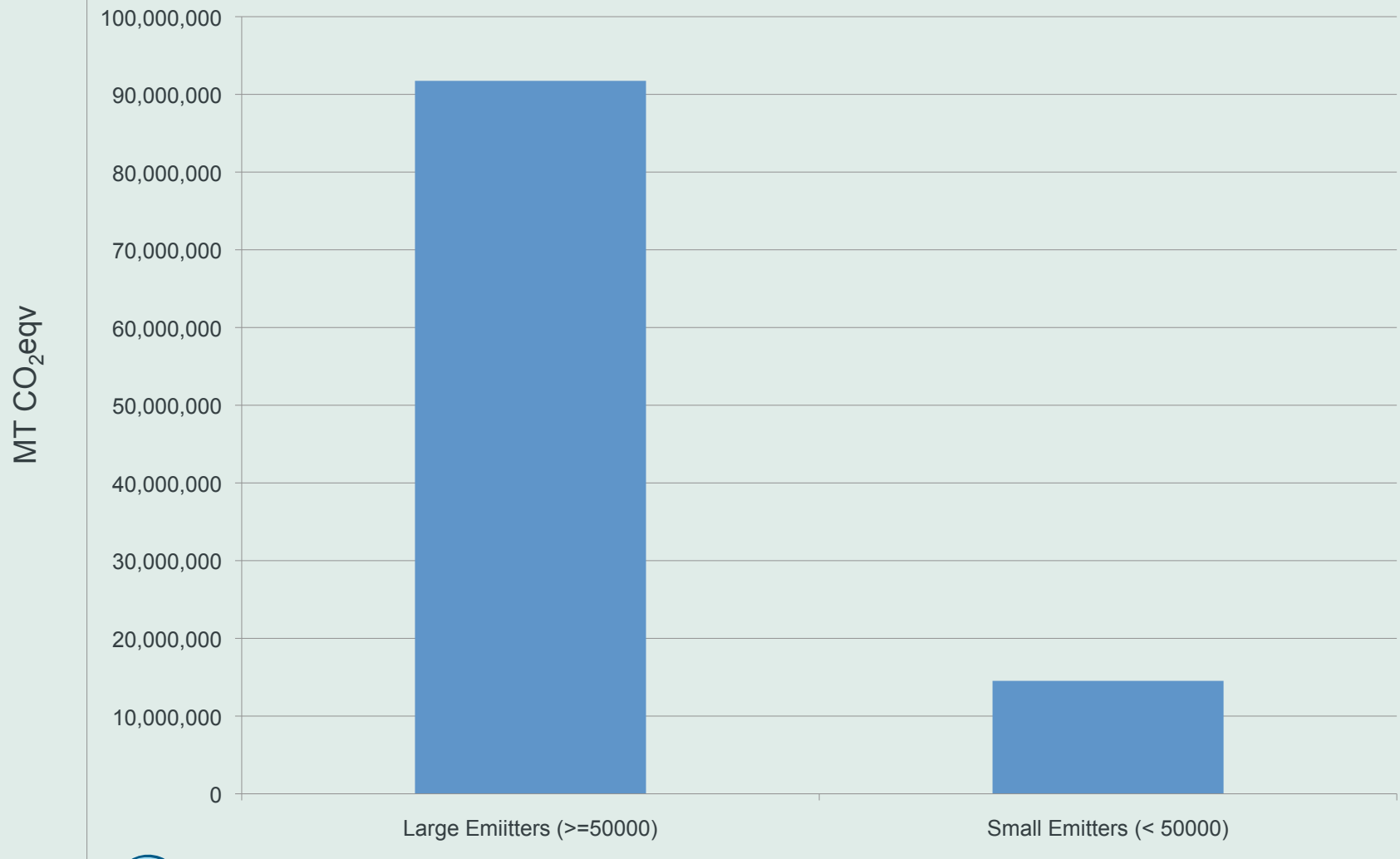
# Landfill Methane Emissions--Bottom 25 States



# Many landfills with methane emissions have energy recovery/methane collection in place



# Many of the emitting landfills of large and likely regulated



# Work extremely preliminary, but

- Suggest significant emissions from regulated landfills, where there is an active methane collection and/or energy recovery system.
- Along with oil and gas, there are clear opportunities to reduce methane in the US.

# Climate and Clean Air Coalition

- In late April ministers and partners from 13 countries and organizations, including US, announced five focal areas for immediate attention. They include:
  - Accelerating the reduction of methane emissions from landfills
  - Speeding up cuts in methane and other emissions from the oil and gas industry.

# Some CATF Black Carbon Work



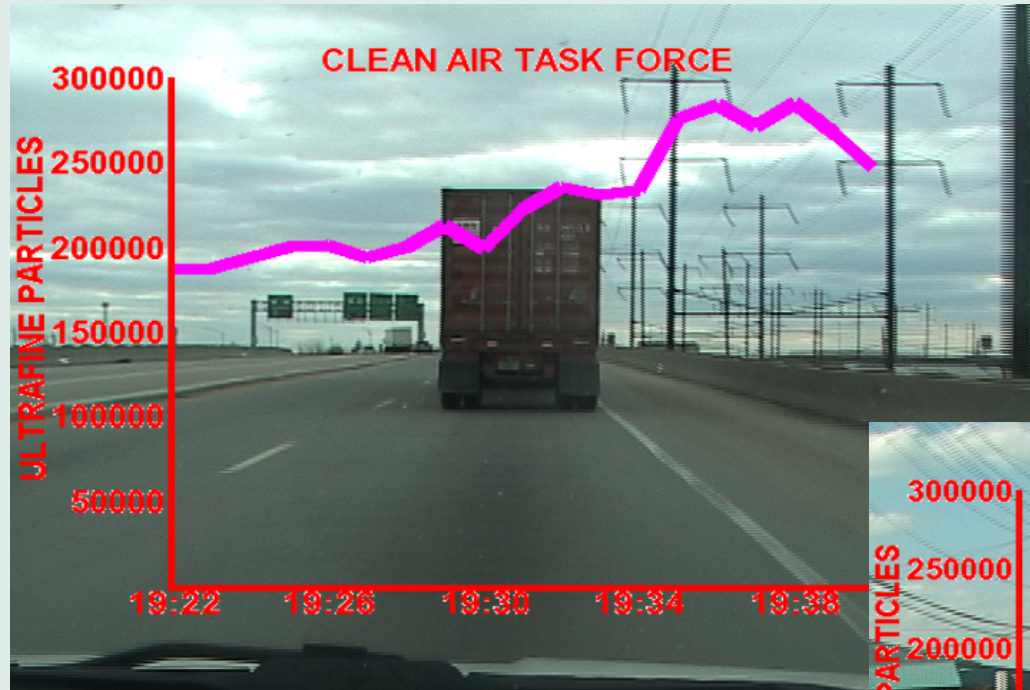
# Communicating Impacts of Short-Lived Climate Pollutants on Regional Air Quality & Climate Change

Univ. of Illinois & Clean Air Task Force project:



1. Survey national & international groups to **ID successes & challenges in communicating SLCP impacts**
2. **Develop new *emissions-to-forcing measures*** to describe relationship between SLCP emissions, regional air quality, and climate
3. Evaluate use of emissions-to-forcing metrics to **communicate the impact of SLCPs to decision- makers**

# DPF technology offers an effective solution, virtually eliminating both PM and BC



*PM emissions before retrofit*

Photos compare PM emissions before and after the installation of a diesel particulate filter (DPF) retrofit.



*After retrofit*

# Filters available to solve the diesel PM and BC problem in the U.S.

Diesel particulate filters (DPF) may be factory installed on new engines, or retrofitted onto older engines to reduce diesel PM emissions by at least 90%.

## HEALTH BENEFITS

- DPFs achieve maximum PM pollution reduction (at least 90% PM reductions)
- Filters are cost effective. For every dollar spent reducing diesel pollution, \$12 is avoided in health damages

## CLIMATE BENEFITS

- Only DPF technology can virtually capture most of the black carbon. If your goal is climate mitigation, then you have to use a DPF.
- will have immediate climate benefits, complementing long-term efforts to reduce CO<sub>2</sub> emissions



***Note: DPFs require ultra-low sulfur diesel fuel***

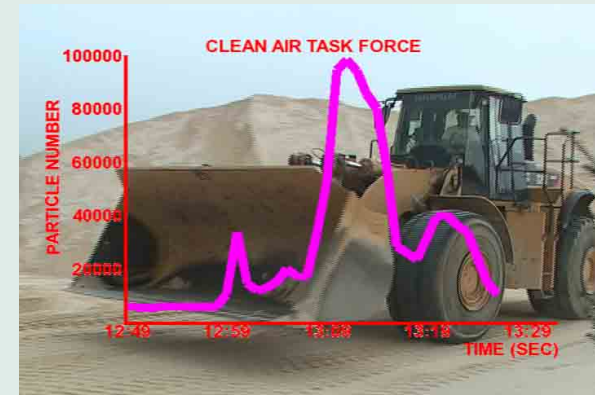
# Actions to support diesel clean-up

## **Federal**

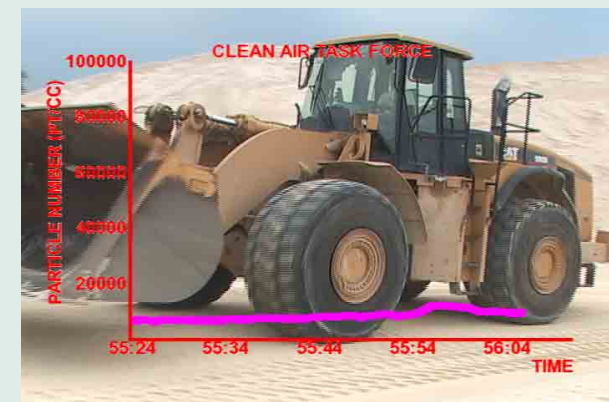
- Support \$30M for DERA in FY 13 federal budget
- Support Clean Construction in Transportation bill reauthorization. Clean Construction would require and fund clean equipment in PM nonattainment and maintenance areas for federal highway projects. Provision was included in Senate's MAP-21. First meeting of House and Senate conference committee May 8.

## **State and Local**

- Adopt clean diesel specifications in contracts for school buses, construction work, waste haulers, etc
- Clean up government fleets – Lead by example
- Support Clean Construction specs in LEED standards (pilot credit coming soon) and other guides
- Incorporate diesel pollution reduction measures into Climate Action Plans, climate legislation, and implementation of other climate commitments
- Include global warming impact of black carbon pollution from diesels in any evaluation of climate change footprint



**Wheel Loader**



**Wheel Loader with DPF**



# Resources

- **Localized health impacts** from diesel pollution in your state and town can be found at [www.catf.us/goto/dieselhealth](http://www.catf.us/goto/dieselhealth)
- CATF coordinates the **Diesel Clean-Up Campaign**, which is currently endorsed by over 525 organizations across the country, providing a presence locally in all 50 states and the District of Columbia. For sample clean construction policies and other information, visit to [DieselCleanUp.org](http://DieselCleanUp.org). We will be adding more resources to the site in coming months. Contact Brooke Suter at [bsuter@catf.us](mailto:bsuter@catf.us) if you want to be alerted when all resources are posted
- **Funding and Financing** for Retrofits:  
<http://www.epa.gov/otaq/stateresources/grants.htm>
- **Short TV Clips and Videos** Demonstrating Retrofits:  
[www.catf.us/projects/diesel/videos](http://www.catf.us/projects/diesel/videos)

# Diesel Clean-up is a Win for *Health, Climate and Jobs*

## Minerals

Diesel clean-up enhances green jobs creation in all 40 states throughout the country. Keybridge Research Associates calculates that every \$1 billion in federal funding for DERA would generate 19,000 jobs; and even more jobs if state, local, or private matching funds are available. Example: Manufacture, distribution, sale and installation supply chain for diesel particulate filters

