

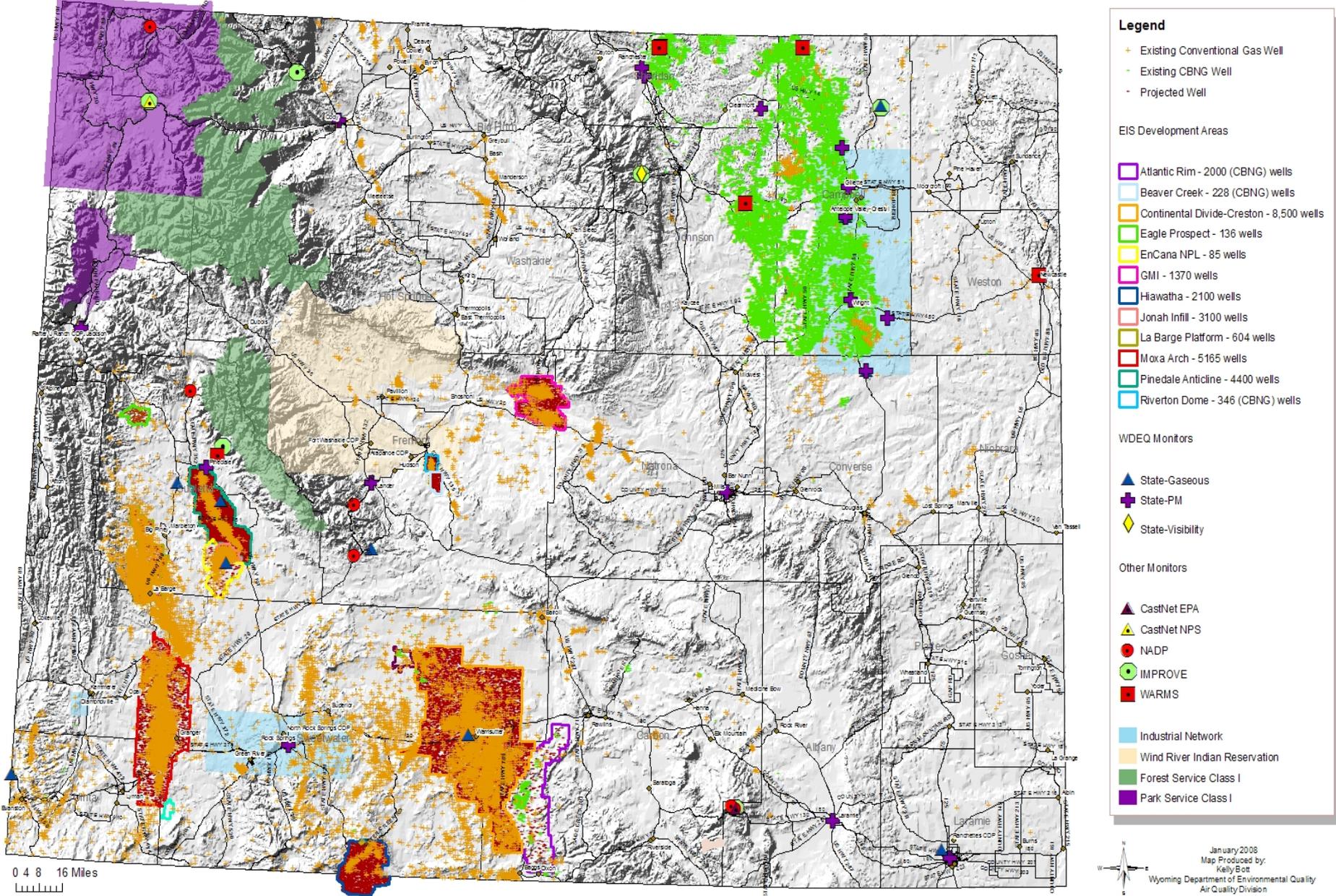


# **Emissions From Hydrofracking Operations and General Oversight Information for Wyoming**

John Corra

Director, Wyoming Department of  
Environmental Quality

# Wyoming Air Quality & Natural Gas Development

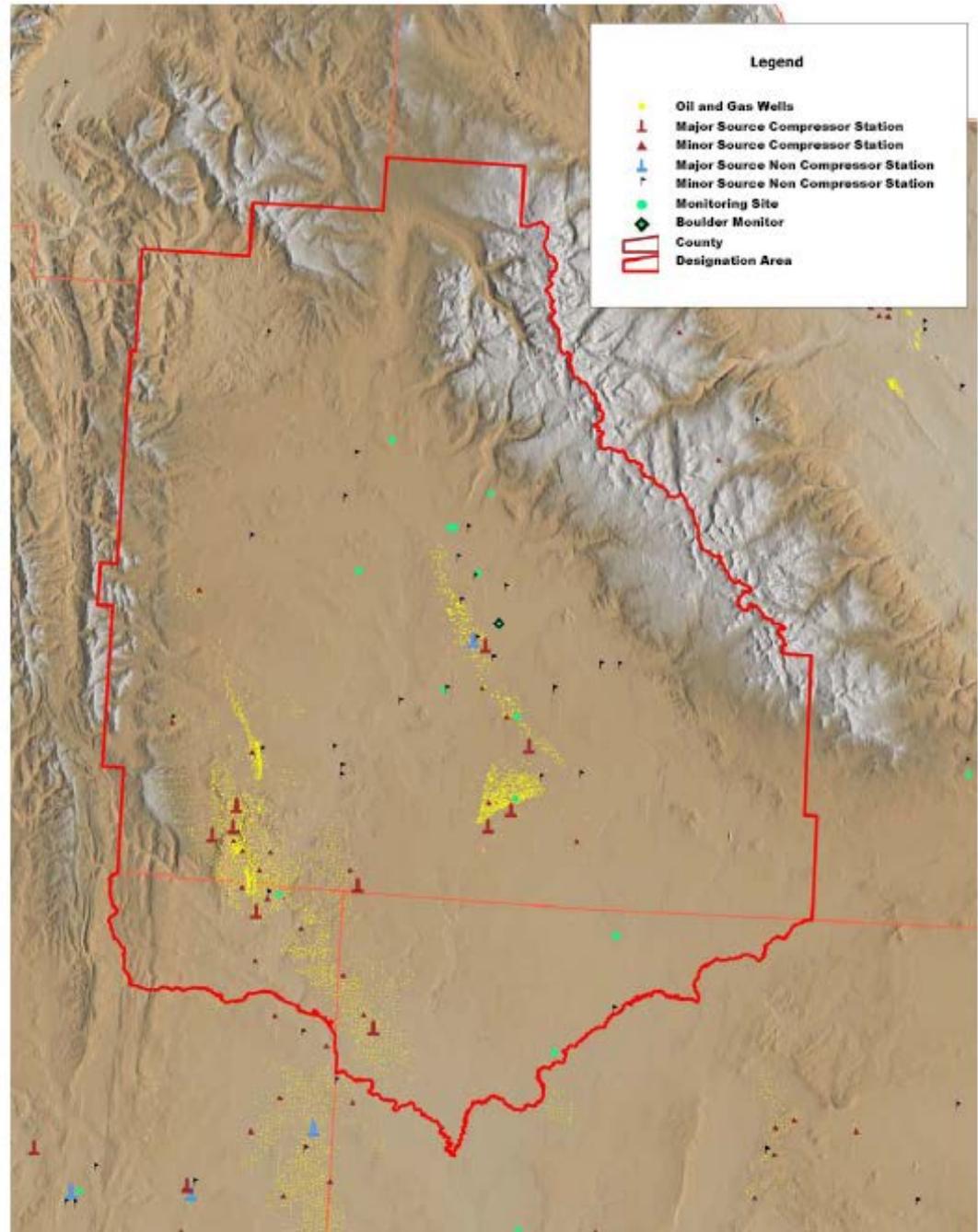




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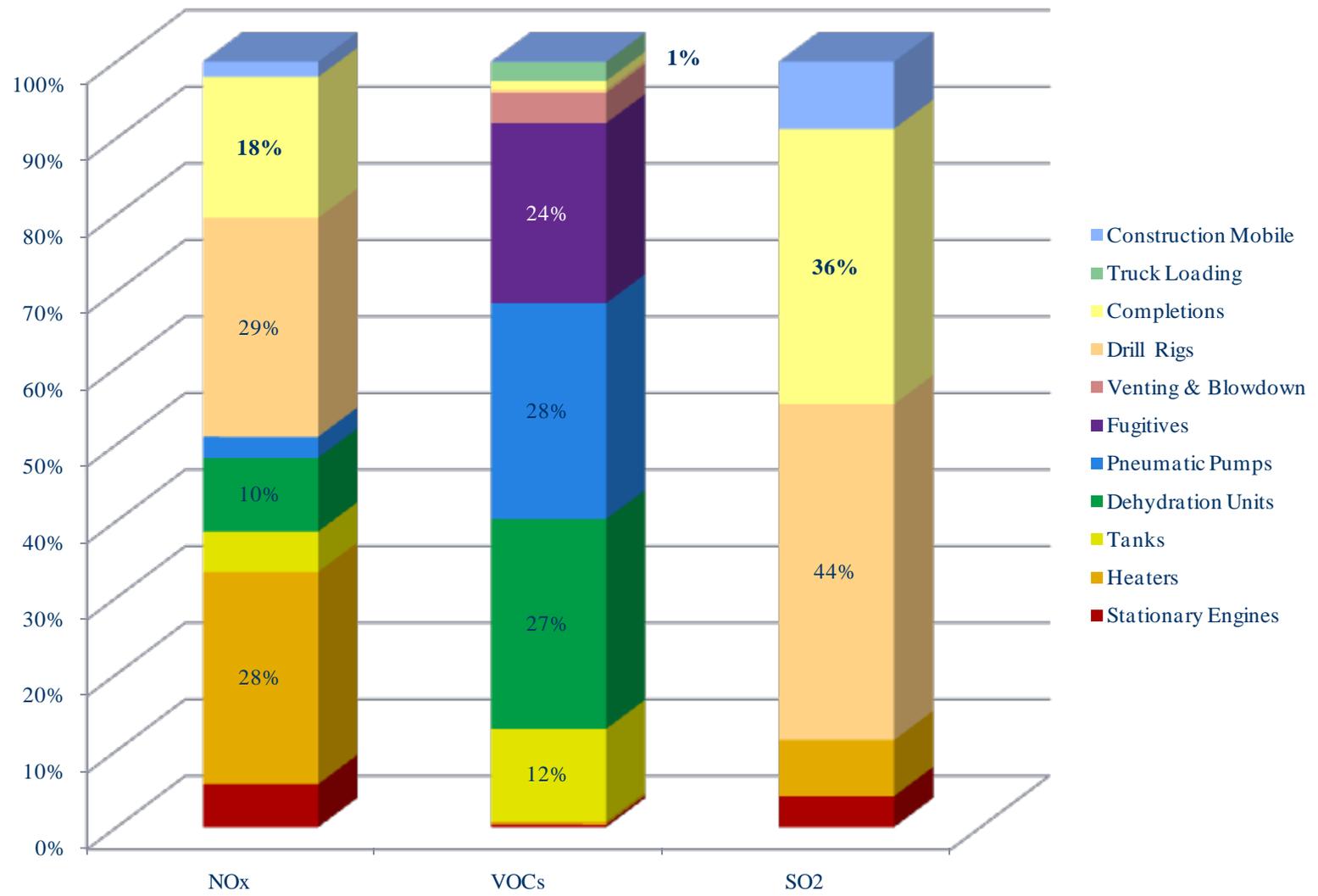
# Emission Profiles and Comparisons for Hydrofracking Operations in Areas of Concentrated Development

The data that follow pertain to the proposed ozone nonattainment area.



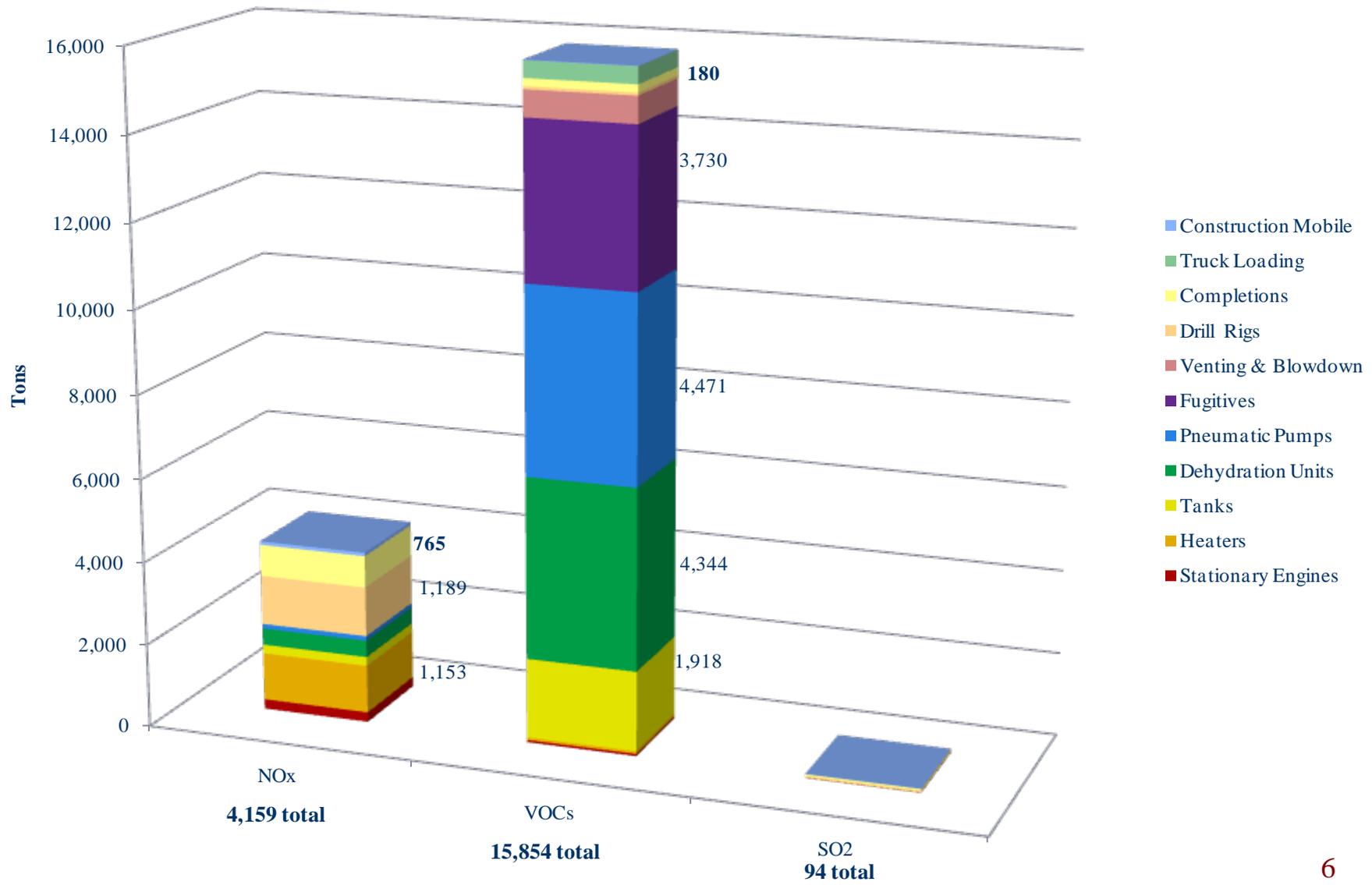


# Distribution of 2009 Total Annual Emissions From Oil & Gas Production



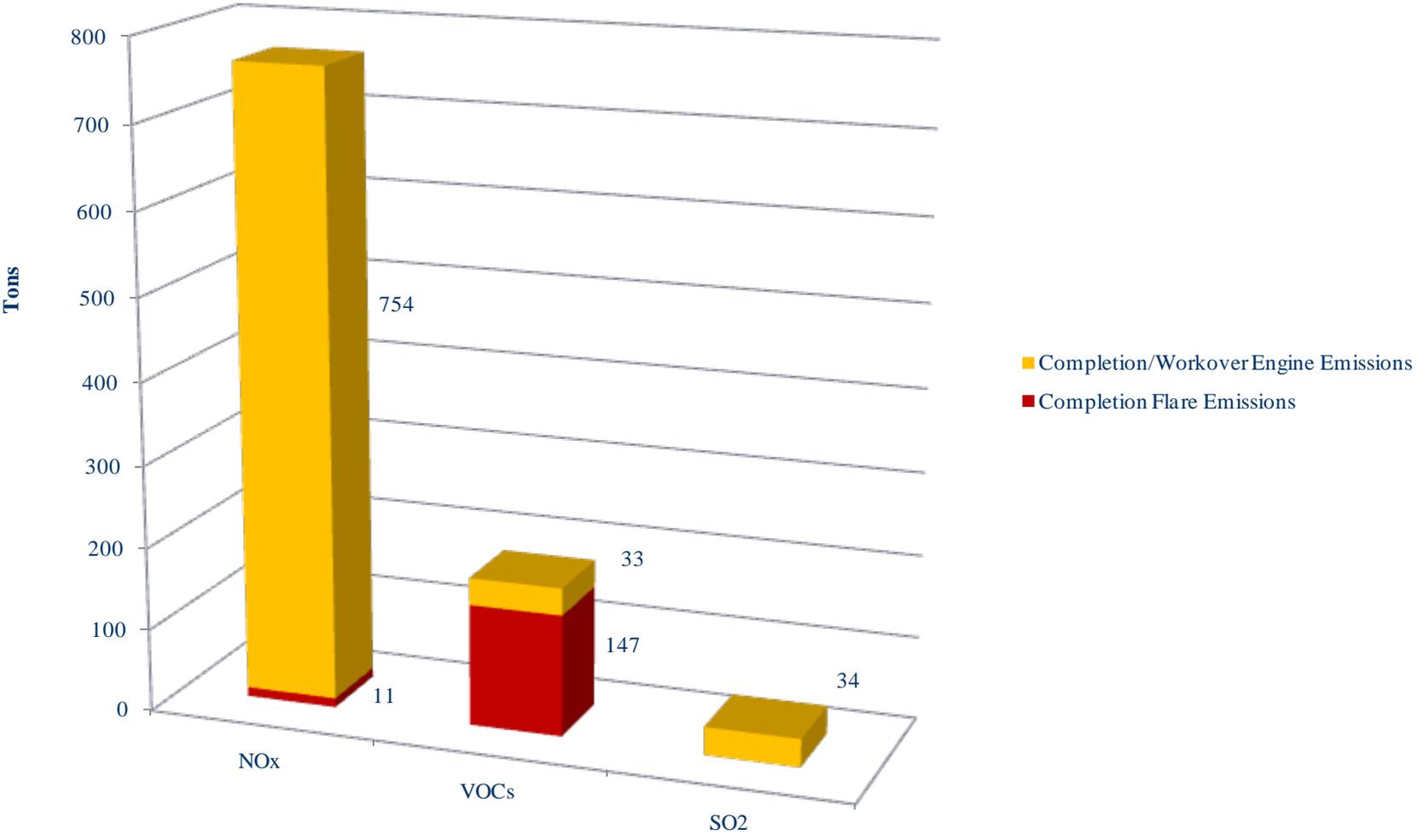


# 2009 Annual Emissions From Oil & Gas Production



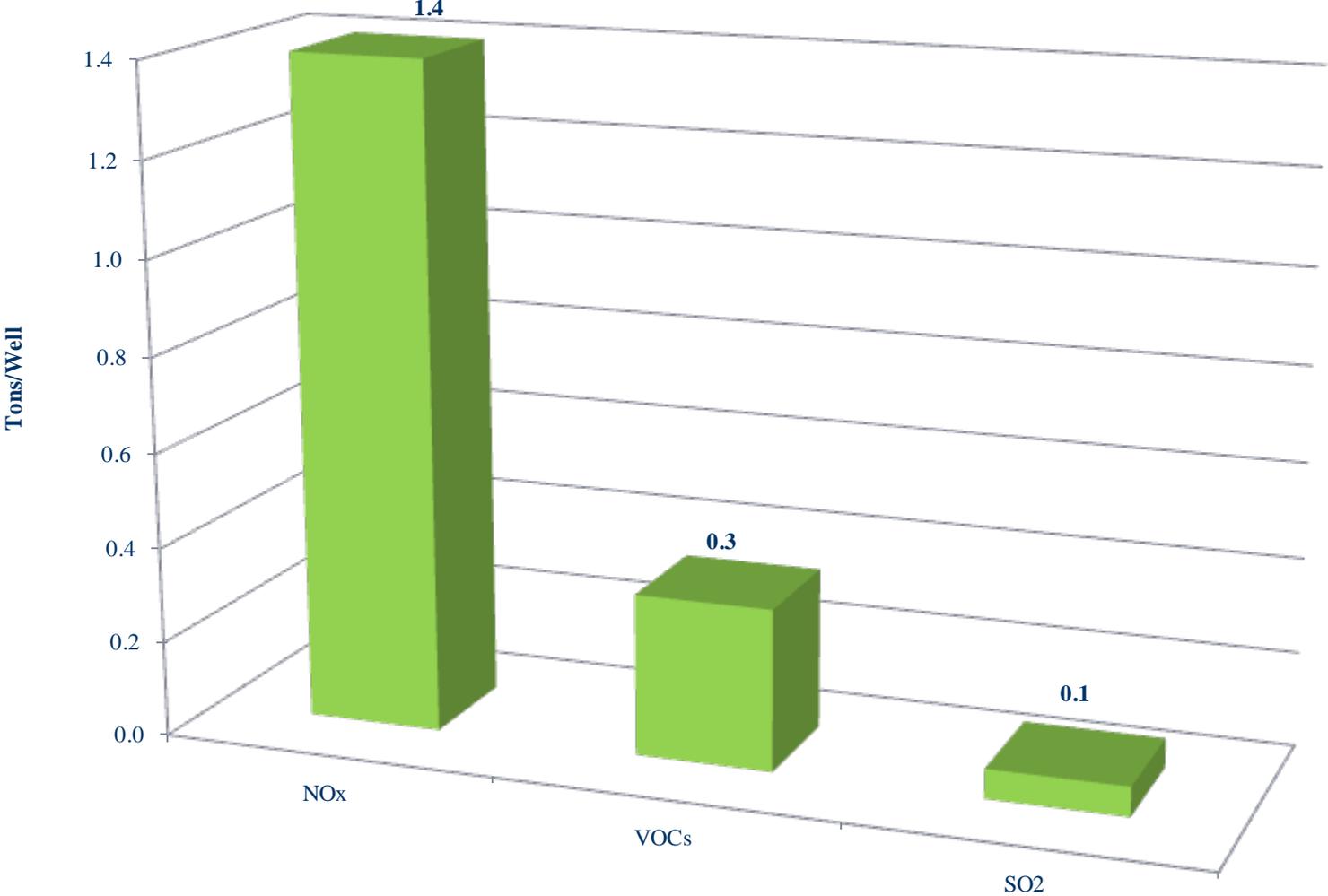


# 2009 Annual Emissions From Completions/Workovers





# 2009 Average Emissions From Completions/Workovers





# Completion Permitting



- ◆ “Green Completion” permits required.
  - Jonah/Pinedale Anticline Development Area since 2004.
  - Concentrated Development Area, which includes 7 counties in southwest Wyoming since 2010.
- ◆ Permits require companies use Best Management Practices to reduce emissions associated with well completions to the extent practicable by selling flowback gas as soon as possible, when possible, rather than flaring or venting the gas.
- ◆ Opacity limited to 20% when flaring.
- ◆ Permits include monitoring, recordkeeping and reporting requirements to demonstrate the use of Best Management Practices (BMP) and to document circumstances when green completions were not possible.



# Best Management Practices (BMPs)



- ◆ Have 4-phase separation equipment on hand and ready when flowback gas is recovered.
- ◆ Arrange for pipeline tie-in prior to well completion.
- ◆ Continually monitor flowback pressure and composition to ensure gas is routed to sales as soon as possible.
- ◆ Proper sizing and rating of equipment to handle high flowback volume and pressure (4-phase separator or solids trap, gas/water/oil separator and dehydrator).
- ◆ Be aware of restrictions by other agencies.
  - i.e., Do not plan to complete wells during Winter Stipulations when the construction of surface facilities, including green completion equipment, is prohibited.



# When Green Completions are Not Required



## ◆ Safety

- When large amounts of proppant are flowed back along with gas and fluids, it may be necessary to flare gas to prevent plugging of separation equipment.
- If surface flowing pressure is high, flow from a new well may be restricted by the “green completion” equipment and this can cause damage to the well bore. It may be necessary to flare or vent during to avoid damage.
- Flowback fluids and equipment are under great pressure and are dangerous to work around. Completion foremen have the discretion to determine the safety of any operation and may divert flow to a pit or flare at any time if an operation is unsafe.

## ◆ Pressure

- When flowing surface pressure at the well is less than line pressure, gas cannot flow to sales and must be flared or vented.

## ◆ Wildcat, Exploratory, Step out Wells

- When no pipeline connection is in place gas sales cannot occur.

## ◆ Mechanical

- Breakdown of separators, line heaters or other equipment or plugging of equipment by solids or hydrates.

## ◆ Flowback gas quality

- Flowback gas is not “pipeline quality” if it contains too much  $N_2$  or  $CO_2$  that was added to “energize” the frack job. (Pipeline companies will not buy out of spec. gas.)



# Well Completion Emission Reports



COMPLETION EMISSIONS WORKSHEET			
Company	Ultra Resources, Inc		
Field Name	Pinedale Anticline		
Well Name	MESA 9A2 27D		
Completion Start Date	8/18/2010		
Completion End Date	4/23/2011		
<b>Total Gas and Liquids Flared or Vented During Completion</b>			
Gas Flared	1.9410	MMCF	Gas Vented 0.0000 MMCF
Condensate Flared	0.0000	BBL	Condensate Vented 0.0000 BBL
Diesel Flared	0.0000	BBL	
<b>Emissions from Flaring "RAW" Gas</b>			
Flare Combustion Efficiency	60.00%	%	
	1.4124	tons VOC	1.8192 tons VOC/MMCF * flare efficiency
	0.0642	tons HAPs	0.0827 tons HAPs/MMCF * flare efficiency
	0.1481	tons NOx	0.0763 tons NOx/MMCF
	0.0371	tons CO	0.0191 tons CO/MMCF
<b>Emissions from Flaring "RAW" Condensate (assume 90% is combusted)</b>			
	0.000	tons VOC	0.0224 lb VOC/BBL flared
	0.000	tons HAPs	0.0035 lb HAP/BBL flared
	0.000	tons NOx	0.38 lb NOx/1000 gallons flared
	0.000	tons CO	1.9 lb CO/1000 gallons flared
<b>Flashing Emissions from 10% of un-flared "RAW" Condensate</b>			
	0.000	tons VOC	E&P Tank Model 0.0043 tons VOC/BBL
	0.000	tons HAPs	E&P Tank Model 0.0002 tons HAPs/BBL
<b>Emissions from Venting "RAW" Gas and Condensate</b>			
	0.000	tons VOC	1.8192 ton VOC/MMCF Gas + 0.0043 Ton VOC/BBL
	0.000	tons HAPs	0.0827 ton VOC/MMCF Gas + 0.0002 Ton VOC/BBL
<b>Emissions from Flaring Diesel</b>			
	0.000	tons NOx	AP-42 table 1.3-1, 24 lb NOx/1000 gas No.2 oil
	0.000	tons CO	AP-42 table 1.3-1, 5 lb CO/1000 gas No.2 oil
	0.000	tons VOC	AP-42 table 3.3-1, 0.35 lb TOC/MMBtu
	0.000	tons HAPs	not available, assume HAPs = 10% of VOCs (TOCs)
<b>Total tons VOC</b>	<b>1.4</b>		
<b>Total tons HAPs</b>	<b>0.1</b>		
<b>Total tons NOx</b>	<b>0.1</b>		yellow = user input
<b>Total tons CO</b>	<b>0.0</b>		blue = calculated values
			orange = calculated totals

Permittee enters barrels of hydrocarbon liquids and MMCF of natural gas recovered during the completion activity.

Emission factors and measured parameters are used to estimate emissions associated from flaring and/or venting the recovered fluids.

If greater than 10% of the recovered gas is flared, completion records are reviewed by WDEQ to determine whether if permitted BMPs were followed.

For the purposes of this spreadsheet, "RAW" refers to condensate and gas that are produced directly from the wellbore as opposed to condensate and gas that have been separated from the wells stream by production equipment.



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# **General Permitting Information for the Oil and Gas Industry in Wyoming**



# Wyoming Minor Source Permitting



- ◆ Permitted over 14,000 oil & gas wellsites.
- ◆ Best Available Control Technology (BACT).
  - All new/modified sources required to address BACT.
    - Required BACT for oil & gas wellsites since 1995.
  - Minor source BACT equivalent to PSD Top-Down BACT.
    - O&G facilities – Minor source BACT can be more stringent than PSD BACT.
- ◆ Ambient Impact Analysis.
  - Most minor sources required to perform cumulative ambient impact analysis.
    - Compressor stations, natural gas plants.
    - O&G wellsites have been included in the analysis.
  - Periodic increment assessment.
    - 2005: Class I and II increment assessment of SW WY (incl. O&G wellsites).
    - Continue to evaluate statewide the need for periodic assessments.



# Selected Oil and Gas Guidance Permitting Requirements



- ◆ Jonah/Pinedale Anticline Development Area.
- ◆ Control Installation upon First Date of Production or Modification.
  - Tank Flashing - 98% control of emissions
  - Dehydration Units - 98% control of emissions
  - Pneumatic Heat Trace Pneumatic Pumps and Other Pneumatic Pumps (chemical, methanol injection) - 98% control of emissions
  - Pneumatic Controllers - Low or No-Bleed OR discharge routed into closed loop system
  - Well Completions - Green Completion Permits
  - Produced Water Tanks - 98% control of emissions
  - Blow down / Venting - Best Management Practices
  - Any Source with No Presumptive BACT Control Requirements (e.g., Truck Loading) - BACT analysis required for uncontrolled emissions  $\geq 8$  TPY VOC or  $\geq 5$  TPY Total HAP



# WOGCC Rules



- ◆ Natural gas flaring permits limited to 250 MCF per day per well.
  - Not to exceed 180 days.
  - Can apply for extension.
- ◆ Flow test flaring is allowed, but limited to 15 days during the well completion process.



# Miscellaneous Information Regarding the Winter Ozone Issue



# Ozone Response - Permitting



- ◆ Wyoming's Oil & Gas Guidance (presumptive BACT requirements) strengthened 8/07, 8/10.
- ◆ Interim permitting strategy implemented July 2008.
  - New/Modified sources in Sublette County allowed with:
    - 1.5 to 1 VOC offsets
    - 1.1 to 1 NO<sub>x</sub> offsets
- ◆ Implementing permitting system for drill rigs in Jonah/Pinedale Anticline Development Area.
  - Emissions controls
  - Engine replacements



# Ozone Response – Other Actions

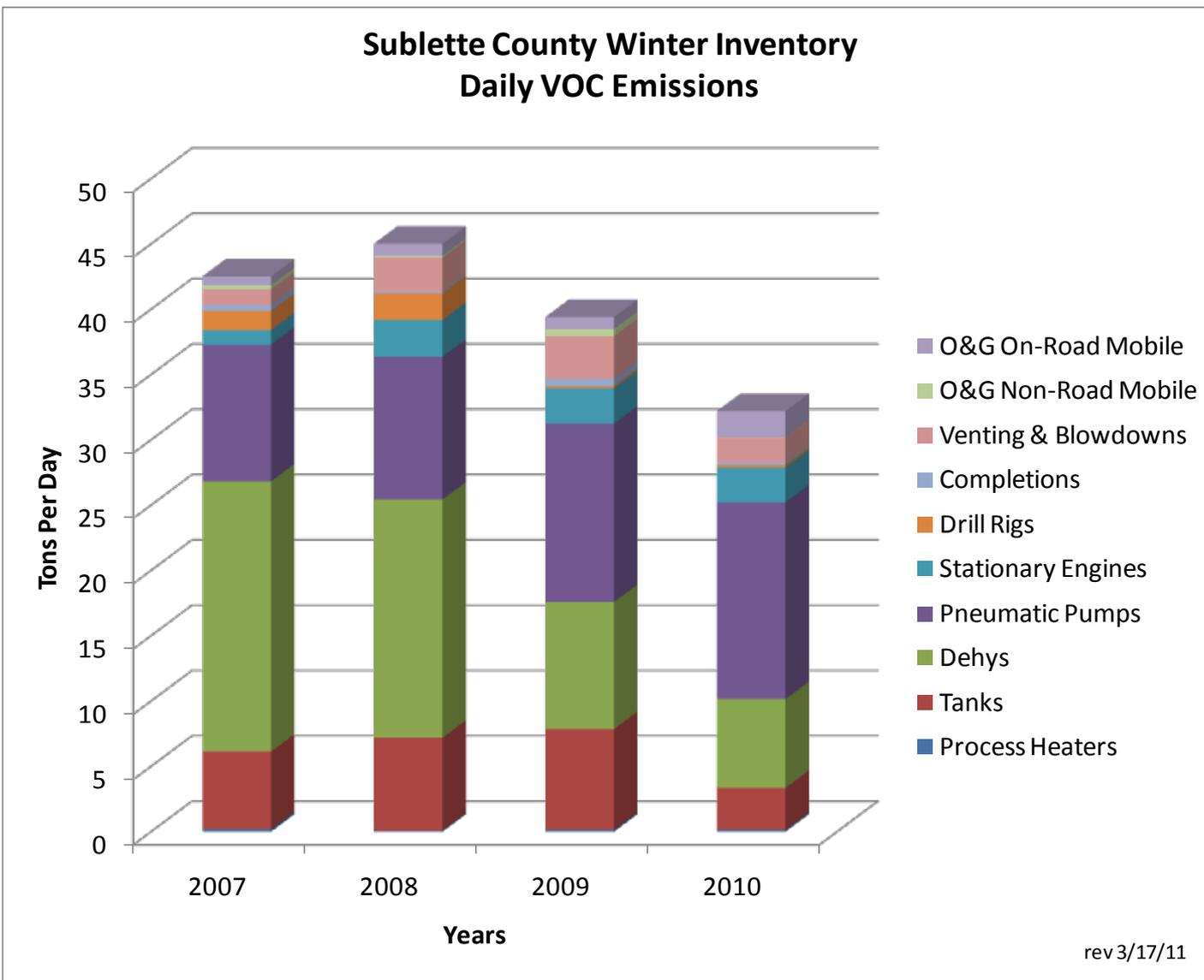


- ◆ Increased inspections
- ◆ Forecasting and Ozone Advisories
- ◆ Studies
- ◆ Liquids gathering systems
- ◆ Flareless completions
- ◆ Voluntary contingency plans
- ◆ Added controls on grandfathered sources
- ◆ Voluntary industry efforts



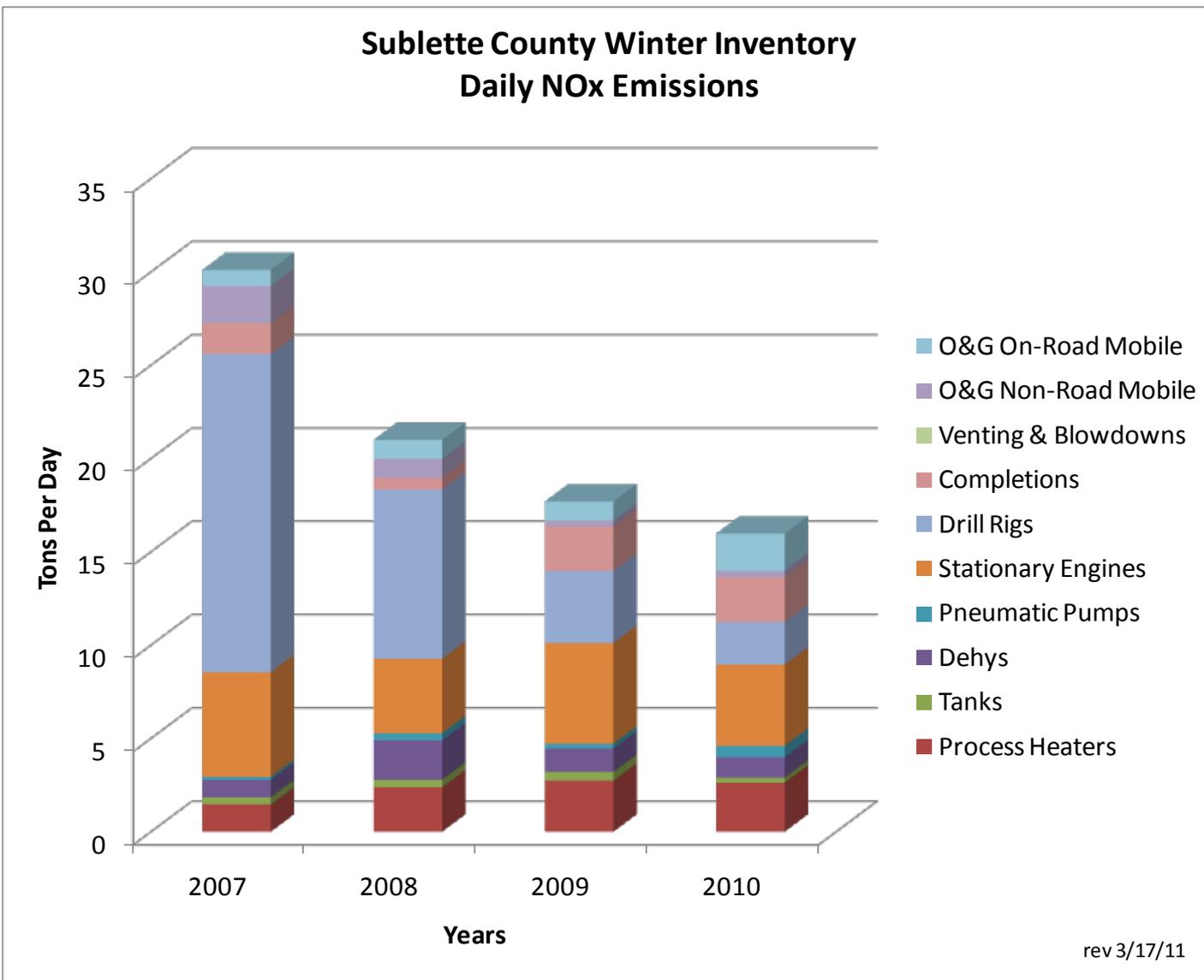
# Emissions of Volatile Organics Declining

Note: Fugitives and emissions from truck loading excluded





# Emissions of Nitrogen Oxides Declining





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**Thank You**