

# Reducing methane emissions from abandoned oil and gas wells

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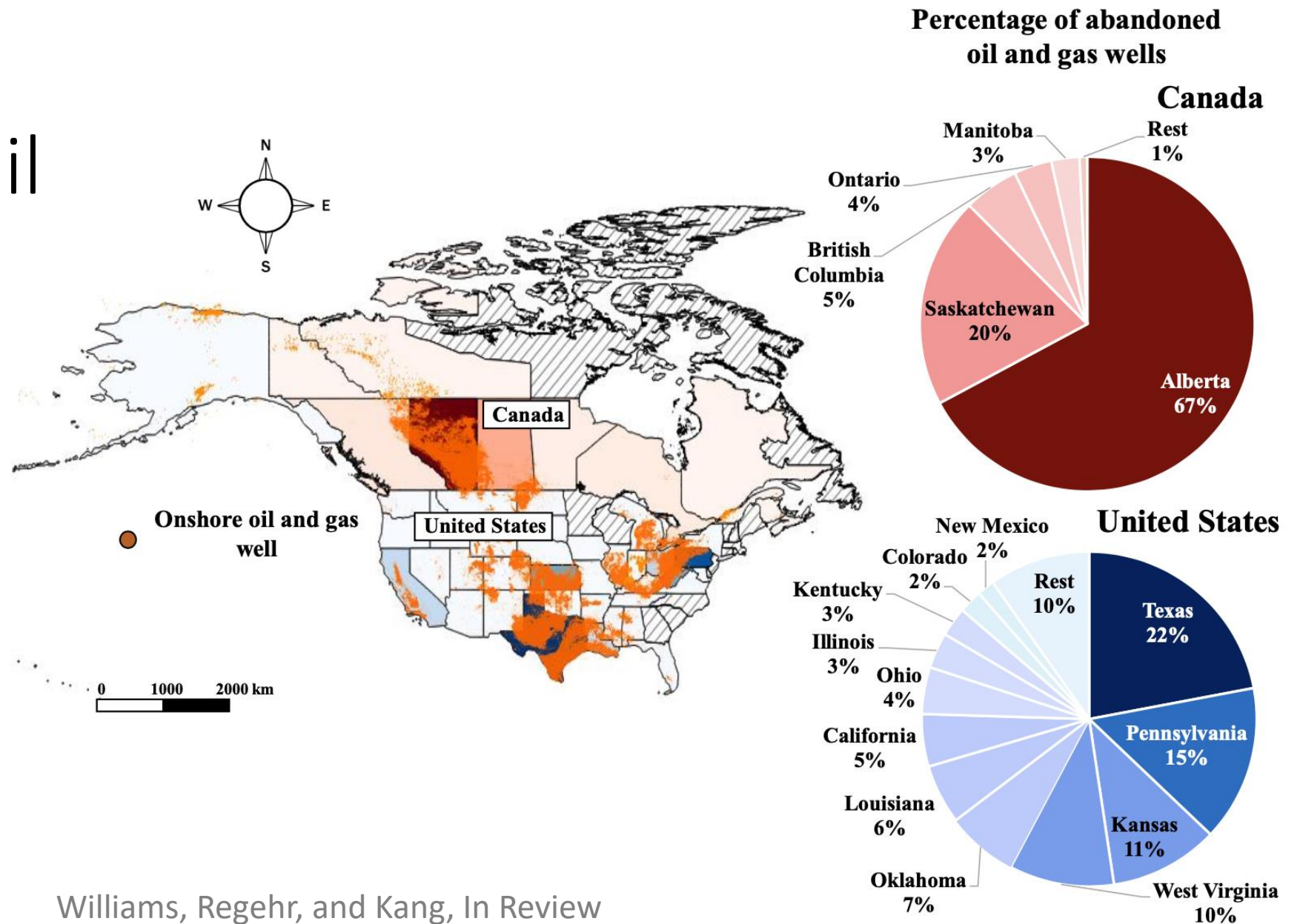
October 20, 2020



**McGill**



>2.5 million  
abandoned oil  
and gas wells  
in the US.  
alone



Williams, Regehr, and Kang, In Review

# Definition of abandoned oil and gas wells varies among states/provinces/territories

The definition by the U.S. Environmental Protection Agency in the U.S. Greenhouse Gas Inventory (2019):

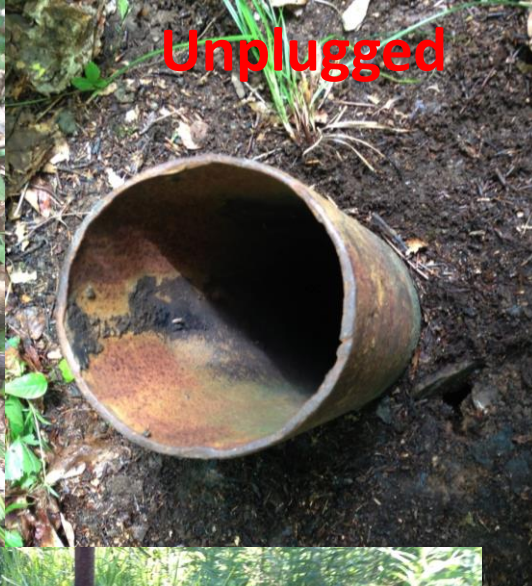
*The term "abandoned wells" encompasses various types of wells:*

- Wells with no recent production, and not plugged. Common terms (such as those used in state databases) might include: inactive, temporarily abandoned, shut-in, dormant, and idle.*
- Wells with no recent production and no responsible operator. Common terms might include: orphaned, deserted, long-term idle, and abandoned.*
- Wells that have been plugged to prevent migration of gas or fluids.*





Unplugged



Unplugged



Plugged



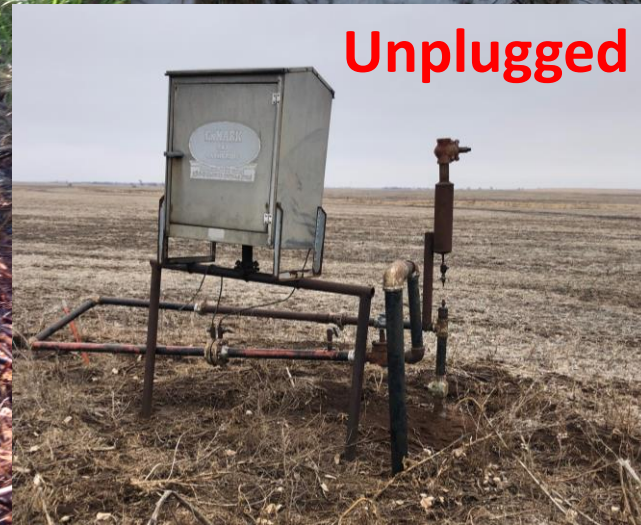
Plugged



Unplugged



Unplugged



Unplugged



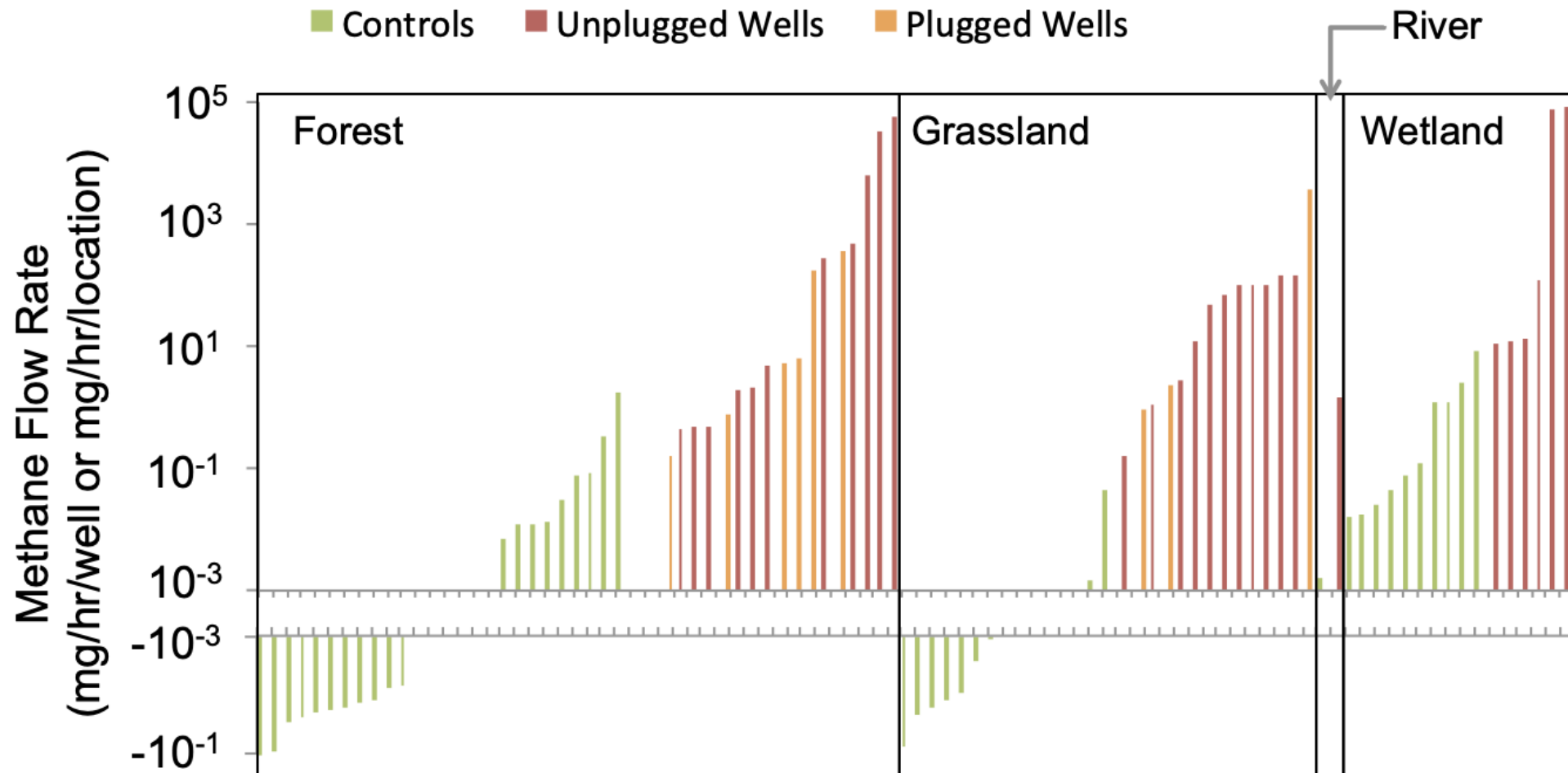
Unplugged



Unplugged



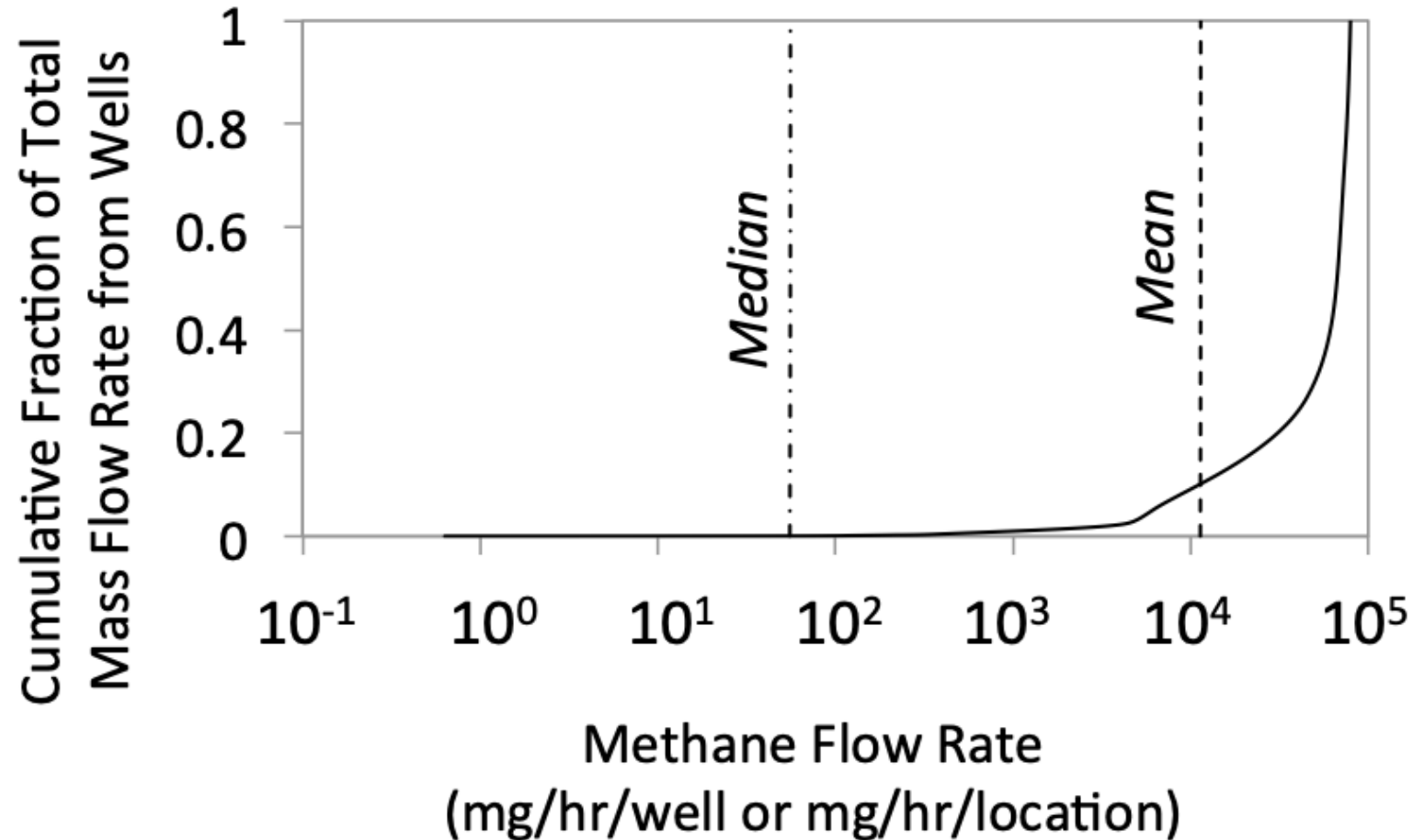
~7 orders of magnitude variation in methane emission rates from abandoned wells



Kang *et al.*,  
PNAS, 2014

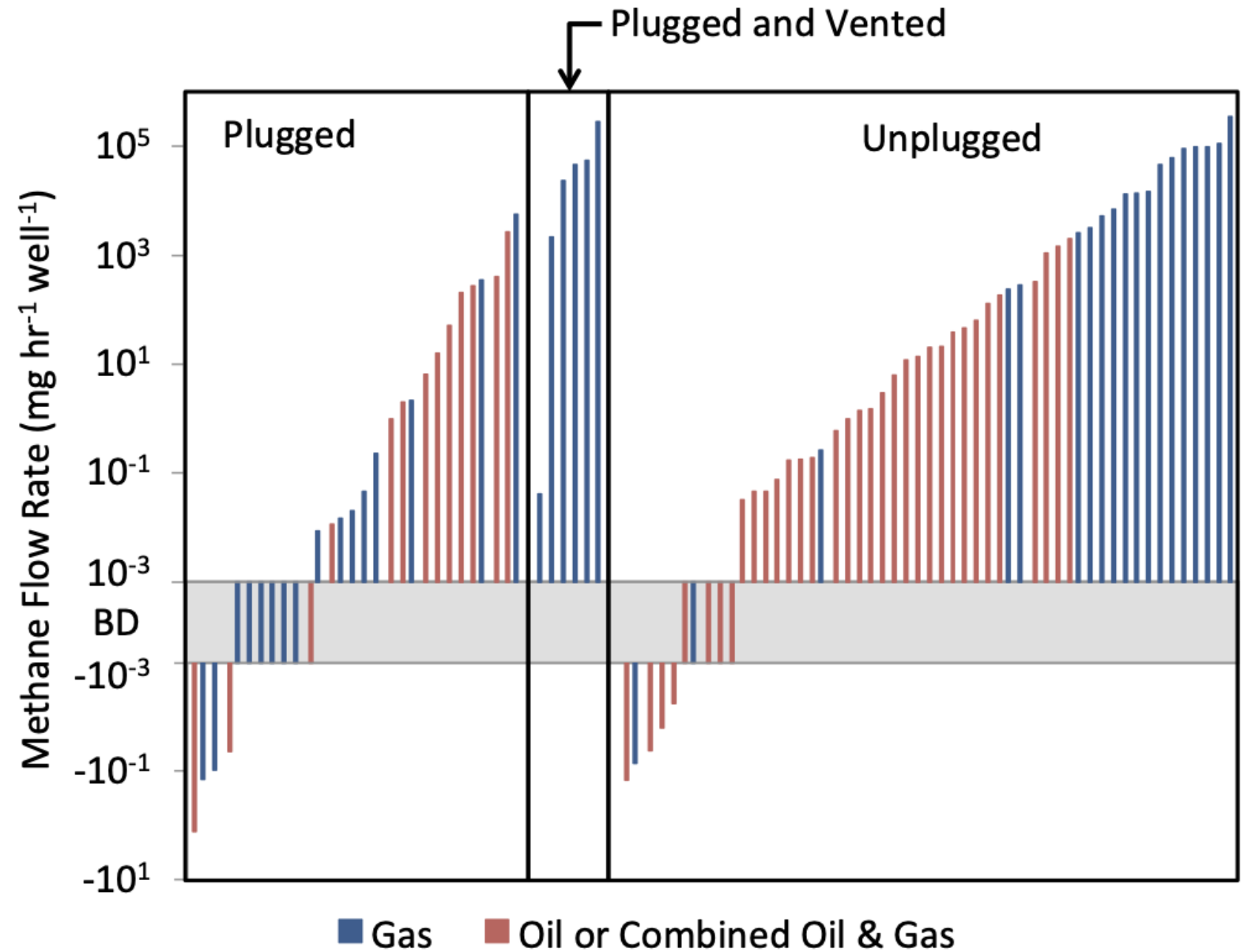
Each bar represents an abandoned well or control location

# High emitters govern emission factors and total emissions



High  
emitters are  
gas wells,  
unplugged  
and plugged  
but vented

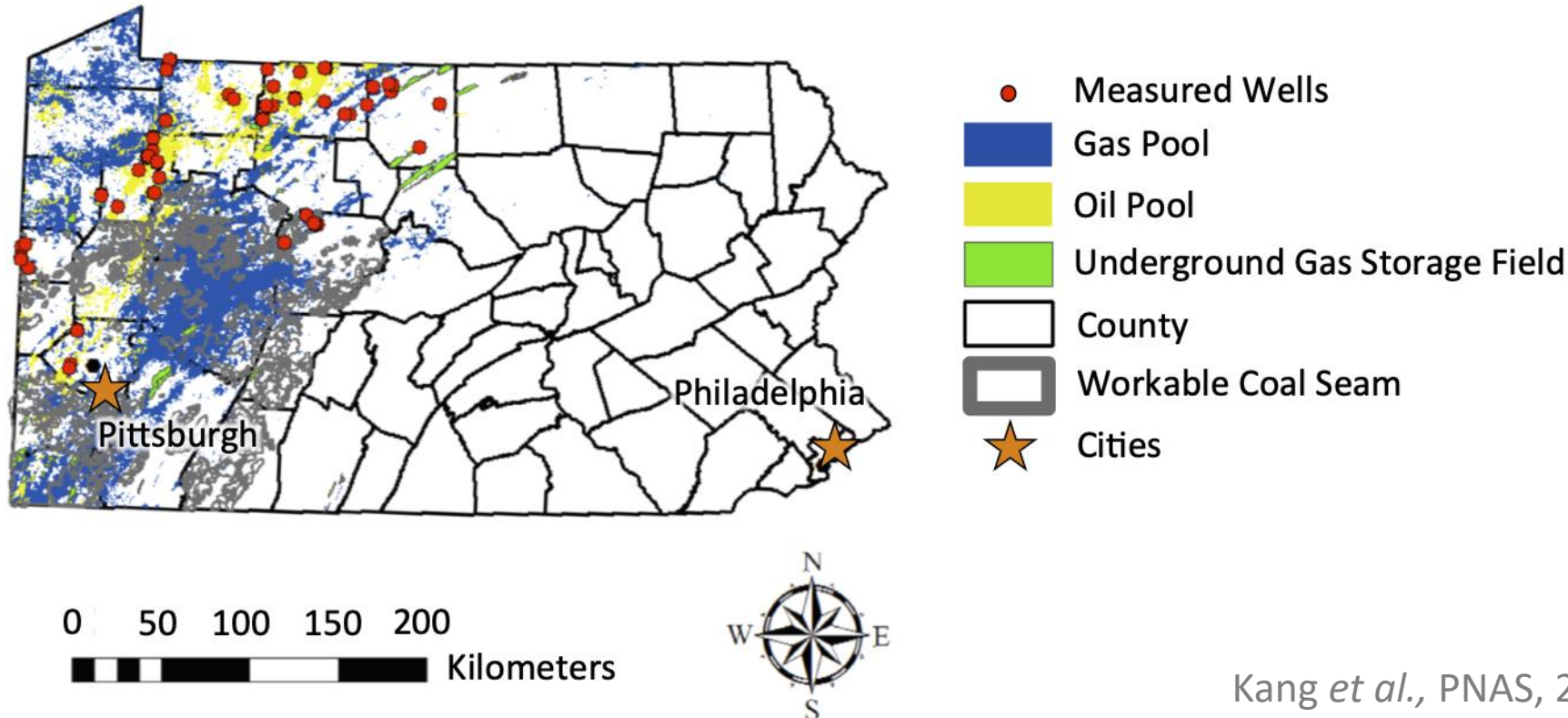
*Plugged wells in coal  
areas are required to be  
vented by regulation.*



Each bar represents the average measured methane flow  
rate at an abandoned well

# Plugged and vented wells in coal areas

- In Pennsylvania, a well is defined to be in a coal area if the well
  - (1) overlies a mineable coal seam,
  - (2) is  $\leq 1000$  ft (305 m) from the boundary of an area with a current Coal Mining Activity Permit, or
  - (3) is in an area for which an underground coal mine permit application is under review



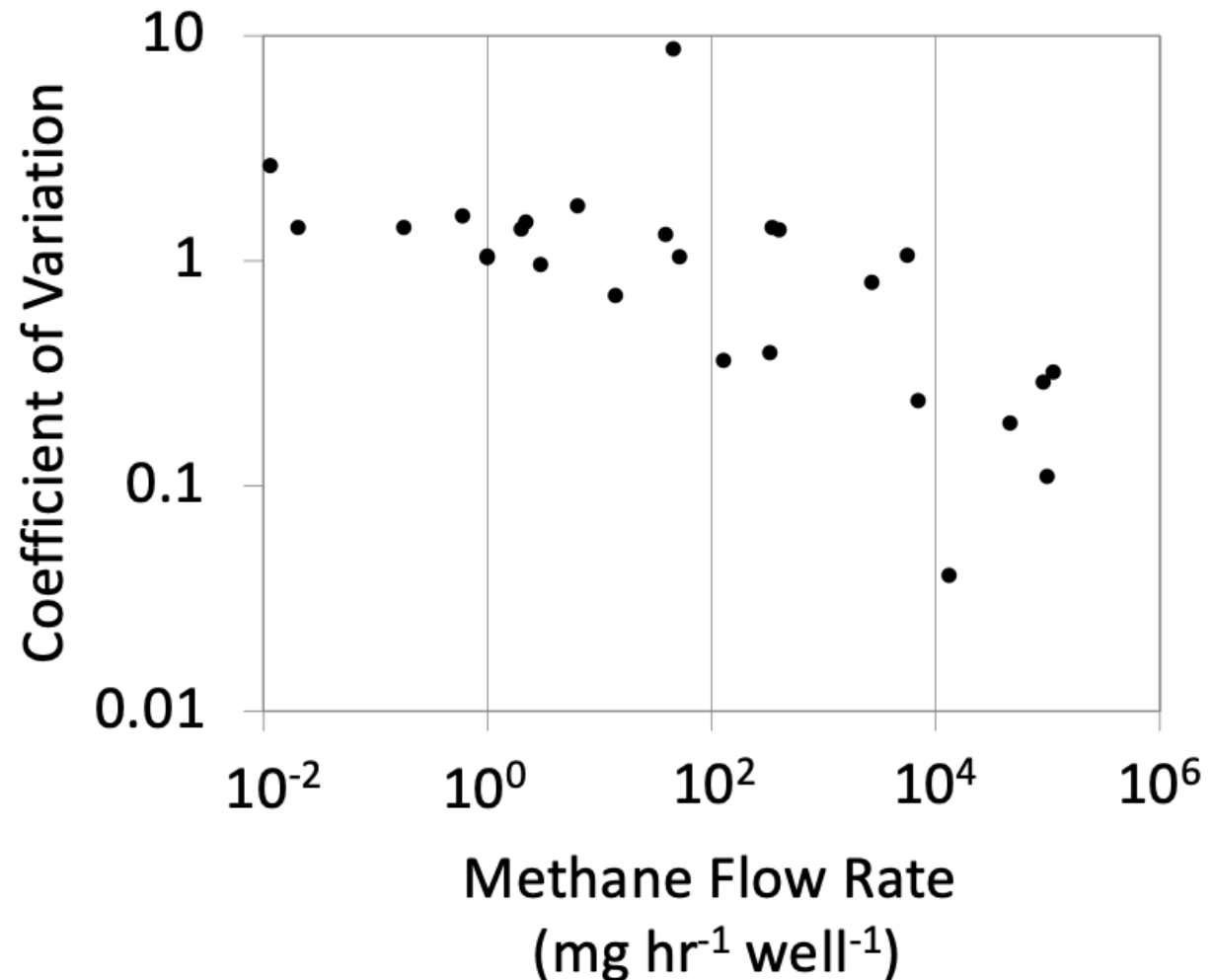
Kang *et al.*, PNAS, 2016



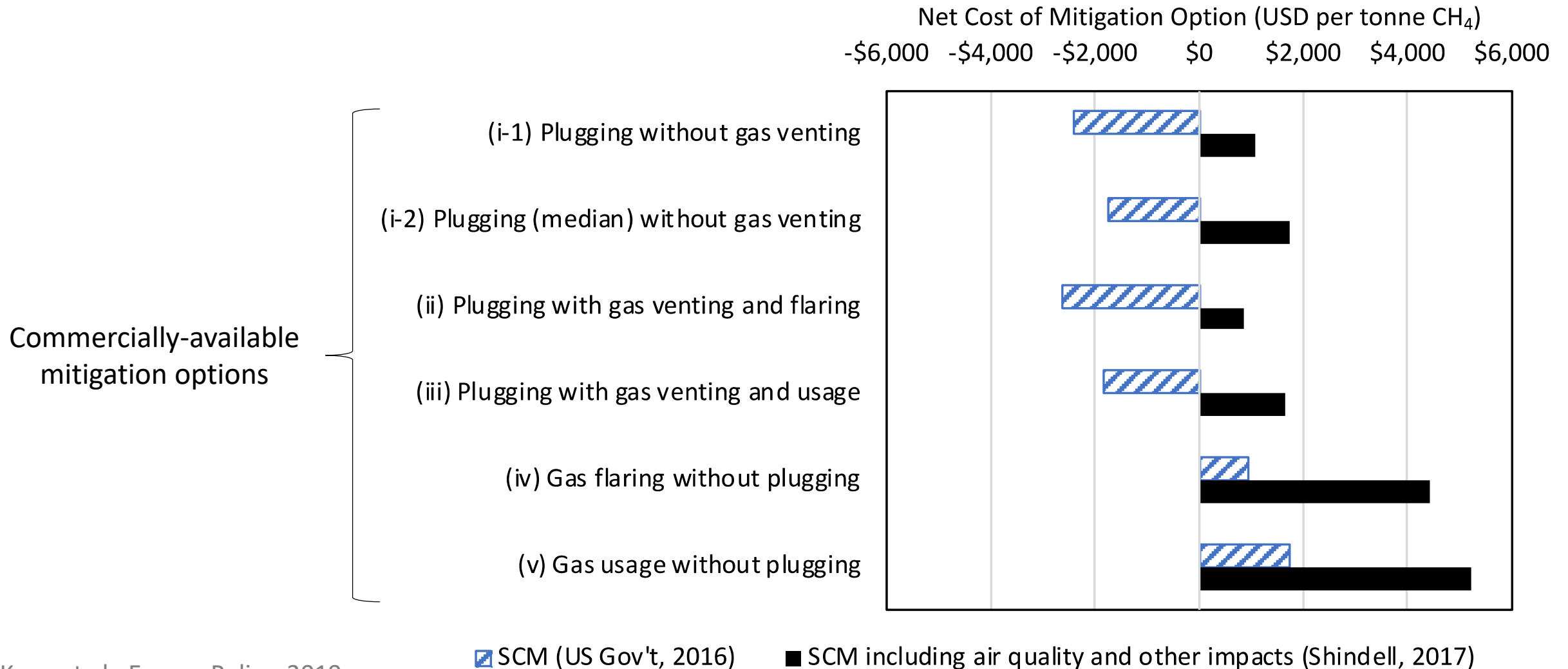


# High emissions continue for multiple years and possibly decades

The coefficient of variation represents variation in repeatedly measured methane flow rates at a given abandoned oil and gas well.

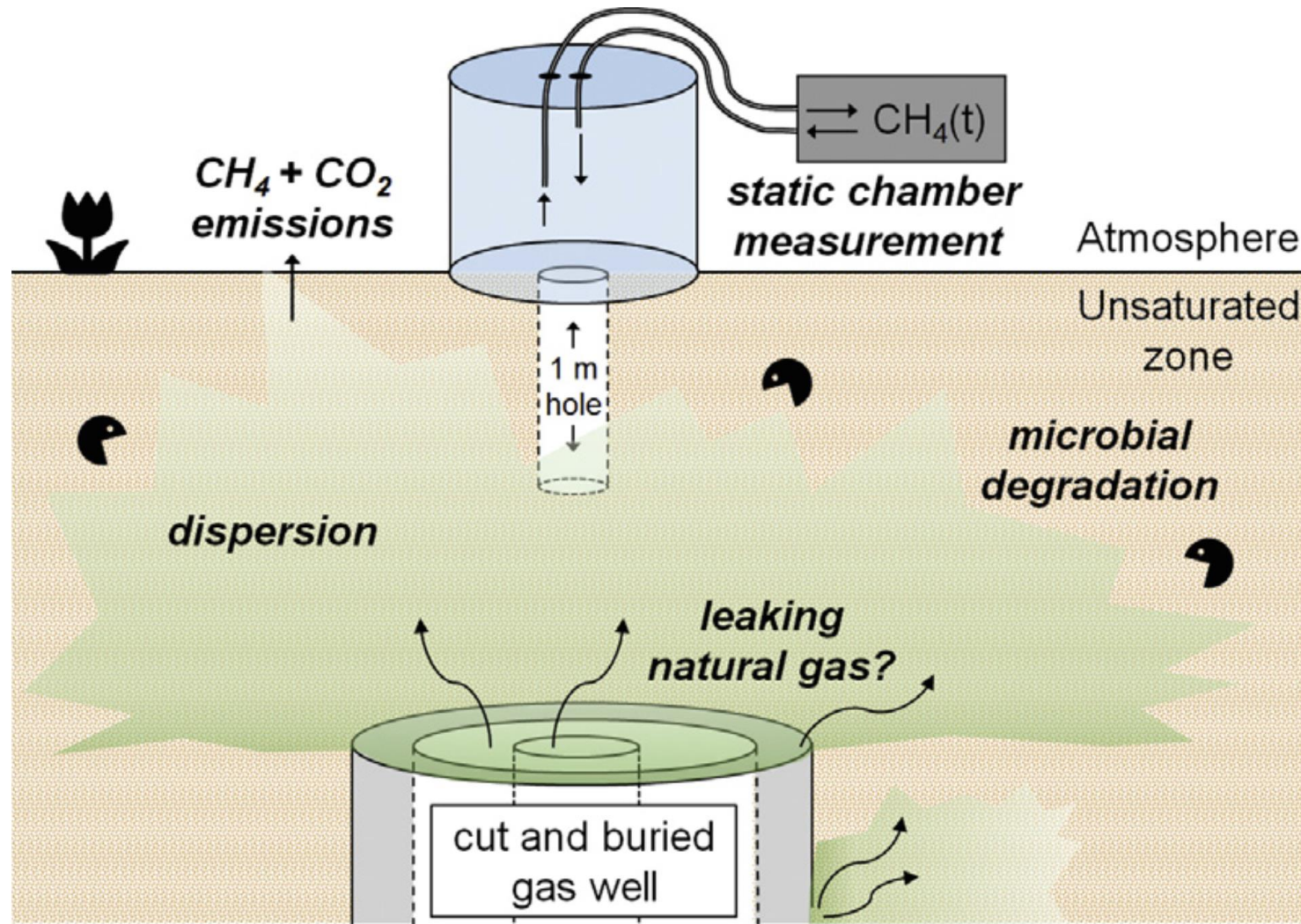


# Mitigation options for methane emissions from abandoned wells not limited to plugging





# Potential for mitigation by soils



# Thank you!



ENVIRONMENT JUNE 16, 2020 / 7:14 AM / UPDATED 4 MONTHS AGO

## Special Report: Millions of abandoned oil wells are leaking methane, a climate menace

By Nichola Groom

15 MIN READ



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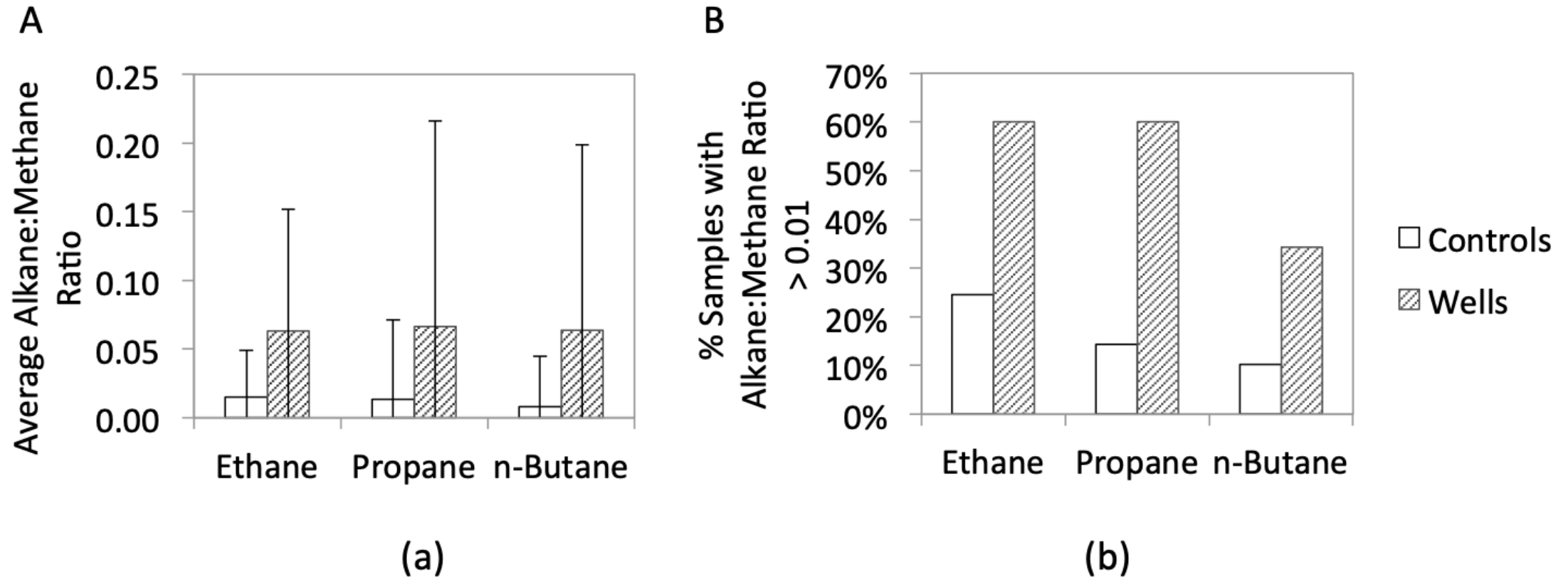
# Appendix

# Methane emissions from abandoned oil and gas wells are the 10th largest methane emitter but are the most uncertain

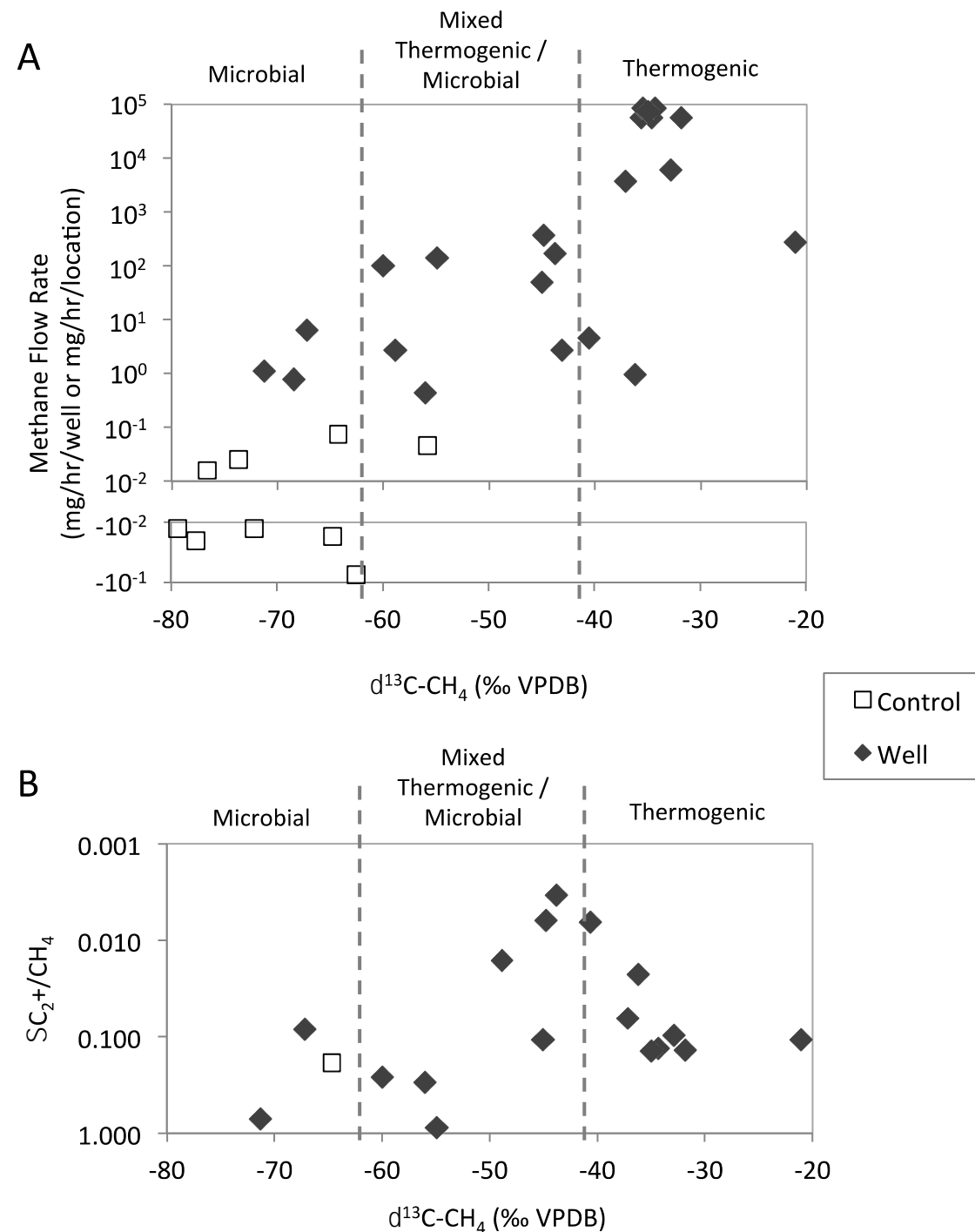
Methane Source	2017 Emission Estimate (MMT CO <sub>2</sub> Eq.)	Uncertainty Range Relative to Emission Estimate	
		Lower Bound	Upper Bound
1. Enteric Fermentation	175.4	-11%	18%
2. Natural Gas Systems	163.5	-16%	17%
3. Landfills	107.7	-11%	40%
4. Coal Mining	53.8	-12%	14%
5. Manure Management	61.7	-18%	20%
6. Petroleum Systems	38.6	-30%	34%
7. Wastewater Treatment	14.3	-28%	21%
8. Rice Cultivation	11.3	-25%	49%
9. Stationary Combustion	7.1	-29%	107%
<b>10. Abandoned Oil and Gas Wells</b>	<b>6.9</b> <i>(14.3 billion standard cubic feet of methane)</i>	<b>-83%</b>	<b>215%</b>
11. Abandoned Underground Coal Mines	6.7	-18%	22%
12. Mobile Combustion	3.5	-8%	27%
13. Composting	4.1	-50%	50%
14. Petrochemical Production	0.4	-57%	46%
15. Field Burning of Agricultural Residues	0.2	-51%	49%



# High emitters are more likely to emit ethane



High emitters  
more likely to  
emit methane  
of thermogenic  
origin





Average plugging costs are  
~\$10,000 per well  
to  
~\$100,000 per well

- Companies who benefited from the well are required to plug the well
- Many wells remain unplugged

