Baseline Methane Concentrations in Drinking-Water Wells in the Appalachian Plateau Province of Western Maryland

Presentation to
Marcellus Shale Advisory Committee
January 6, 2014

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Study Objectives

- Background
  - Methane in well water has been reported anecdotally
  - Methane is not routinely tested for in well water
  - No systematic study of well-water methane has been conducted in Maryland

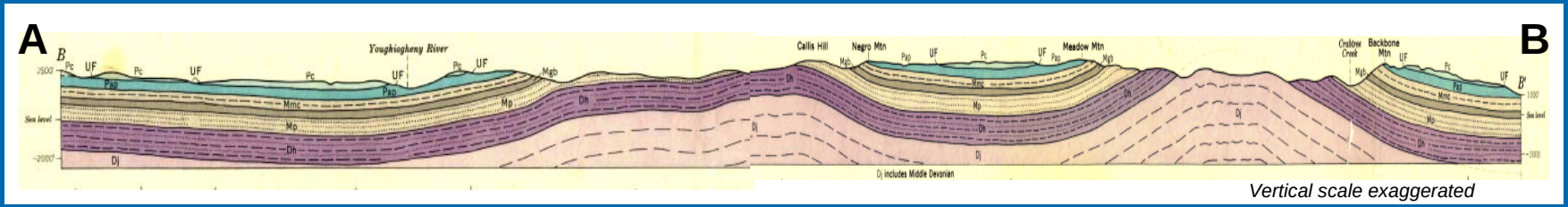
- Goals
  1) Evaluate ambient methane concentrations in water wells in the Appalachian Plateau Province of Maryland
  2) Obtain a general understanding of the occurrence and distribution of methane
  3) Evaluate source(s) of methane in well water
  4) Determine methane variability at individual wells

Methods

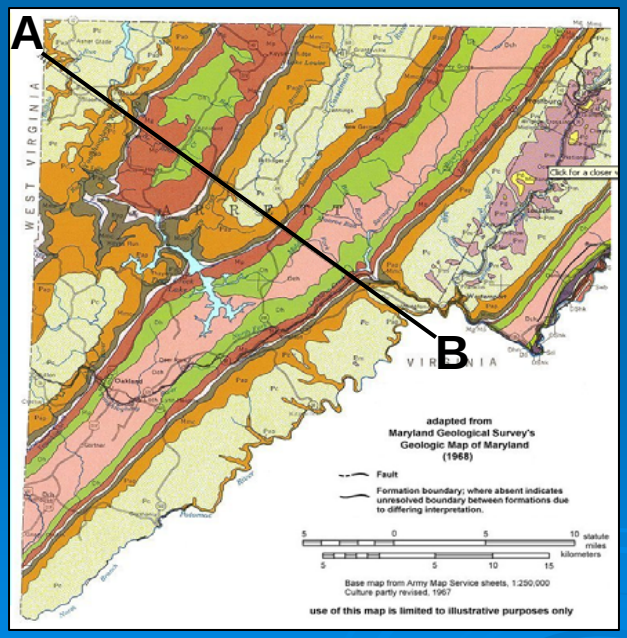
- Well selection process
  - **Geology**
    Coal basins (36 wells)
    Non-coal regions (42 wells)
  - **Topography**
    Valleys (32 wells)
    Hilltops/Hillsides (46 wells)
  - **Other well criteria**
    1. Well permit number
    2. Submersible pump; well in use
    3. Access to untreated well water
    4. Reasonable spatial distribution
    5. No obvious or potential sources of contamination

	Coal	Non-coal
Valley	15	17
Hilltop+ Hillside	21	25

Geologic cross section of Garrett County



Vertical scale exaggerated



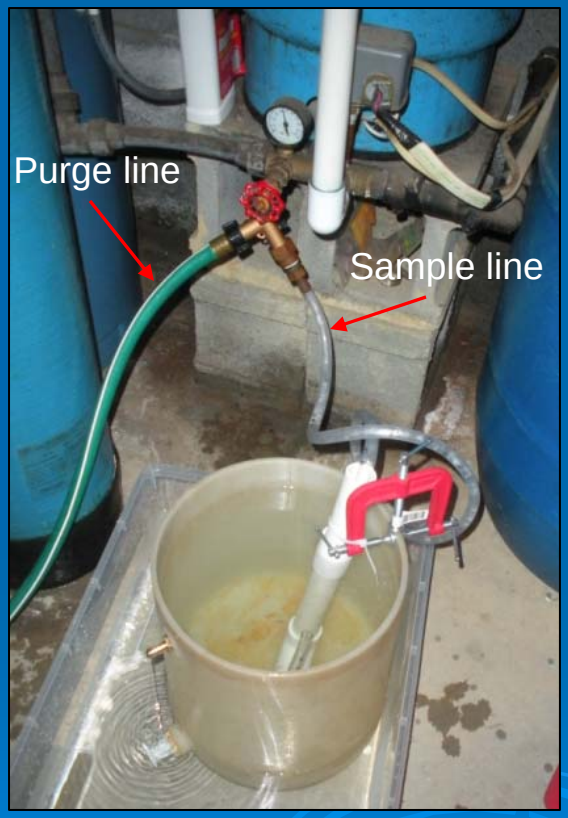
Source: Maryland Geological Survey

Methods

- Sampling procedures
  1. Well purge
     - pH, specific conductance, dissolved oxygen, temperature
     - 5-minute intervals until stabilization
  2. Sample collection
     - Methane sample collected using inverted bottle technique
     - Two 40mL glass vials per well site
     - Field measurements of alkalinity, chloride, and total hardness
  3. Preservation and storage
     - HCl drops added to glass vials (pH<2)
     - Vials stored on ice

Methods

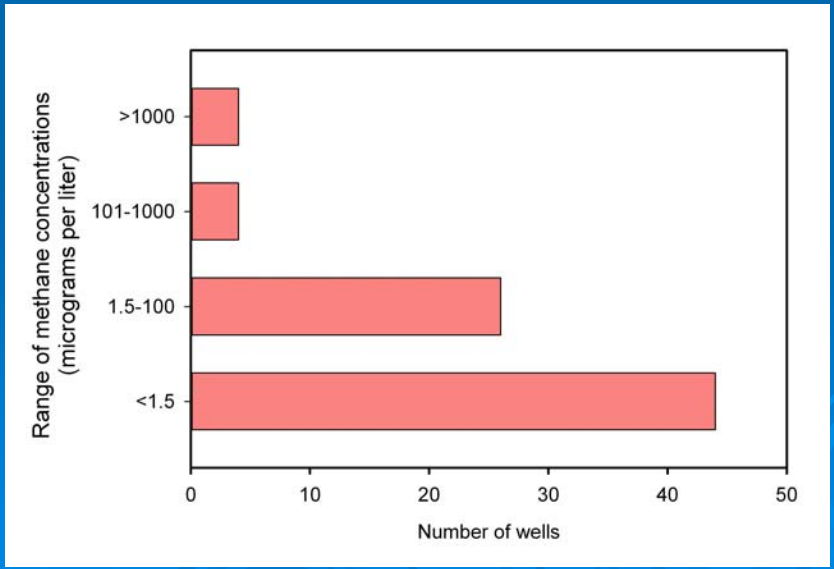
Purge bucket with probes



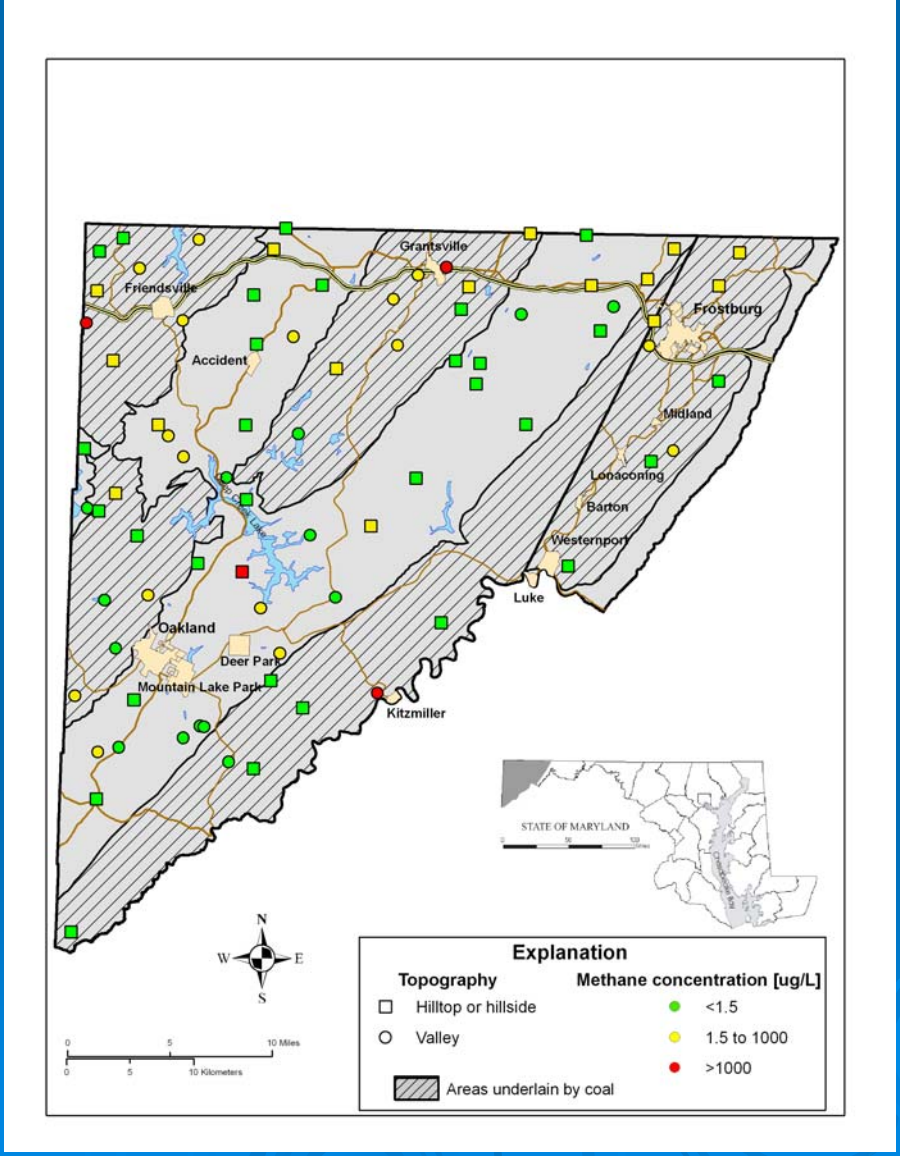
Sampling bucket

Results

- Dissolved methane concentrations ranged from less than 1.5 to 8,550 micrograms per liter (µg/L).
- 44 percent of wells (34 of 78) had methane detections (>1.5 µg/L).
- 56 percent of wells (44 of 78) had no methane detections (<1.5 µg/L).
- 4 wells exceeded 1,000 µg/L of dissolved methane. No wells exceeded the 10,000 µg/L (10 mg/L) recommended action level for dissolved methane.

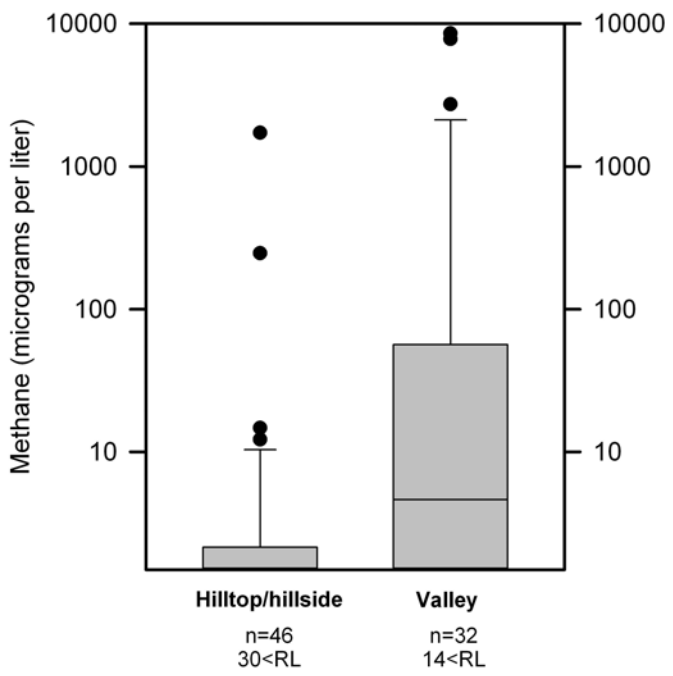


Methane distribution

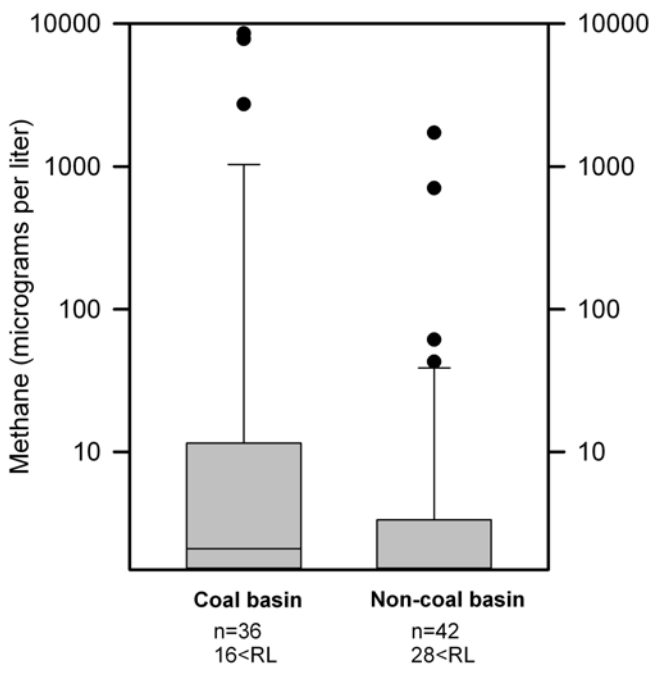


Methane in relation to:

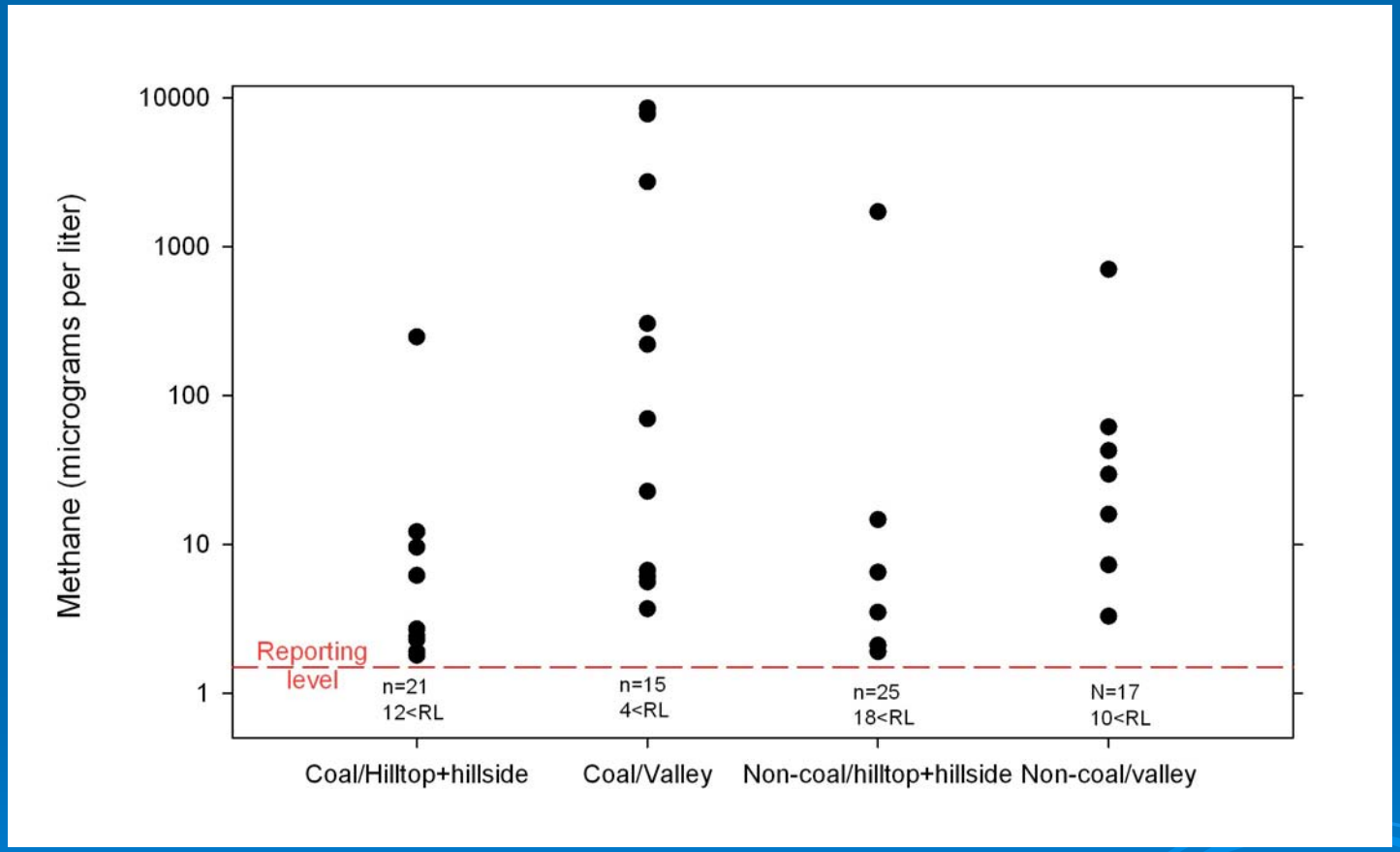
Topographic position

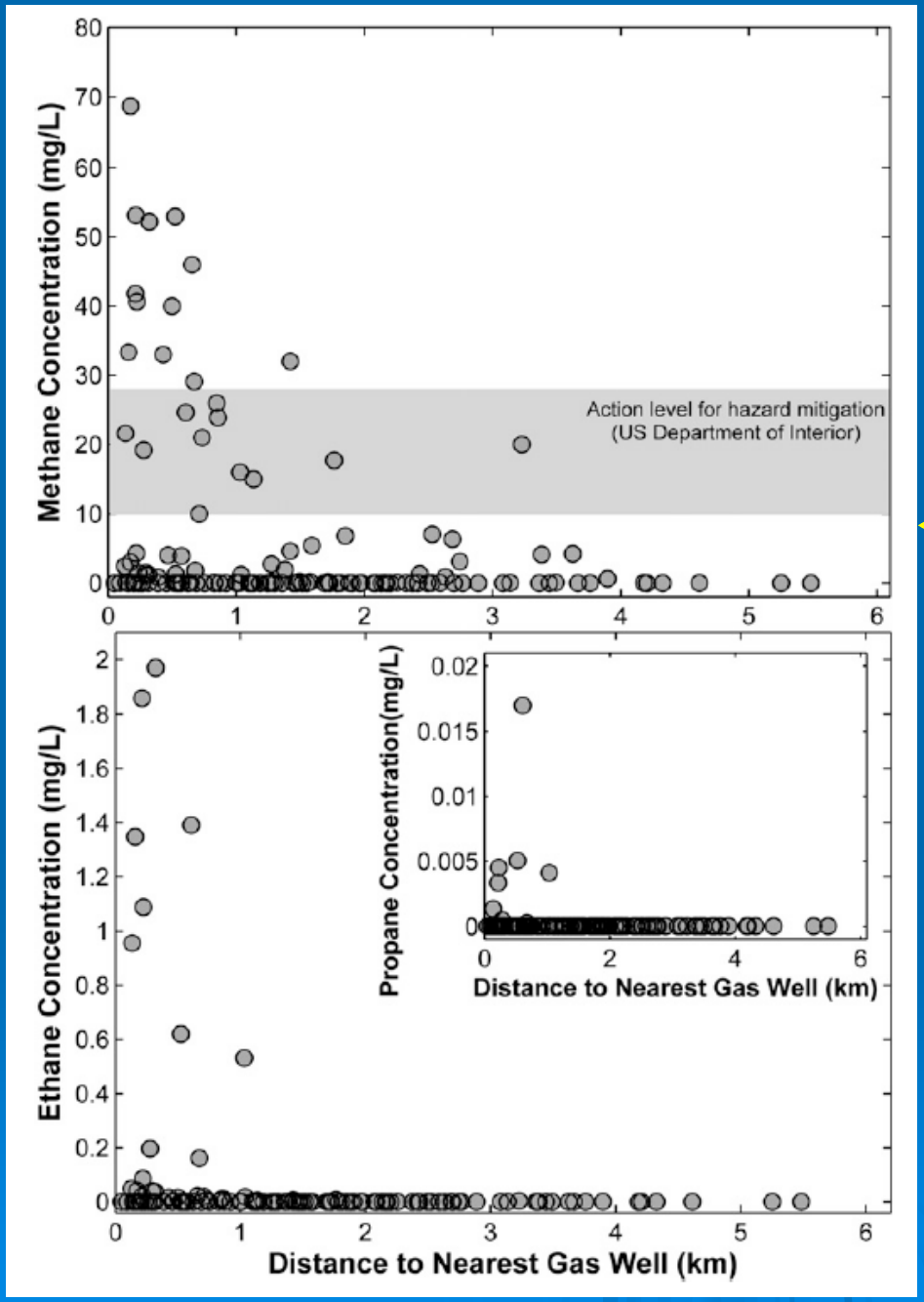


Geologic setting



Methane in relation to both topographic position and geologic setting



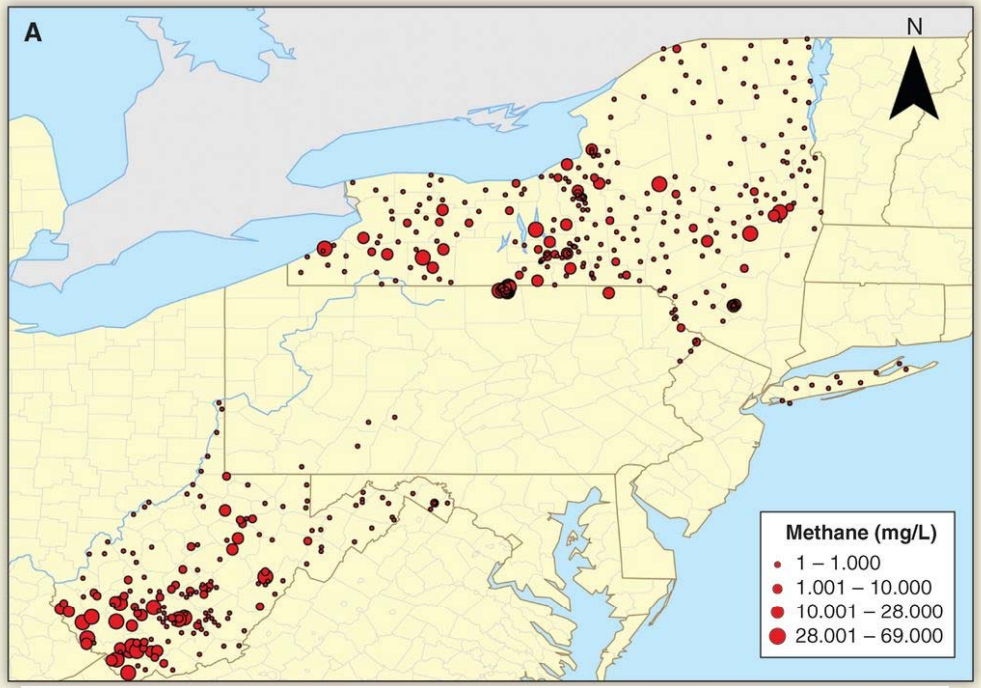


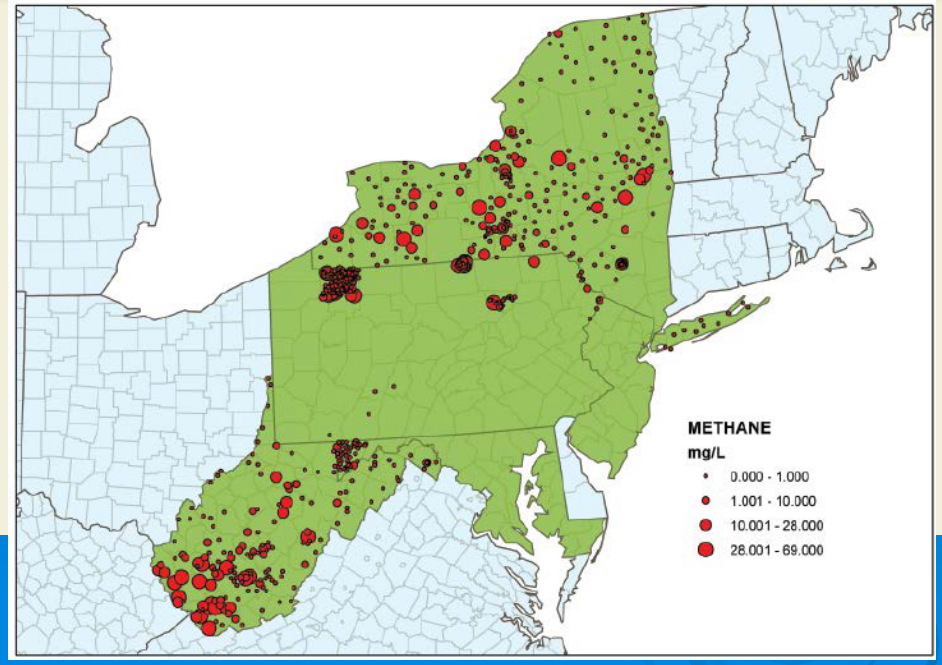
<u>Pennsylvania</u>:
Jackson et al., 2013 PNAS

<u>Maryland</u>:
77 wells; max. CH_4 = 8.55 mg/L

Most wells < 1.5 mg/L

Source: **Dissolved-methane concentrations in well water in the Appalachian Plateau physiographic province of Maryland**
D.W. Bolton & M.P.T. Pham, 2013
Md DNR Admin. Rept. 14-02-01





Impact of Shale Gas Development on Regional Water Quality

R.D. Vidic, S.L. Brantley, J.M. Vandenbossche, D. Yoxtheimer & J.D. Abad (2013)

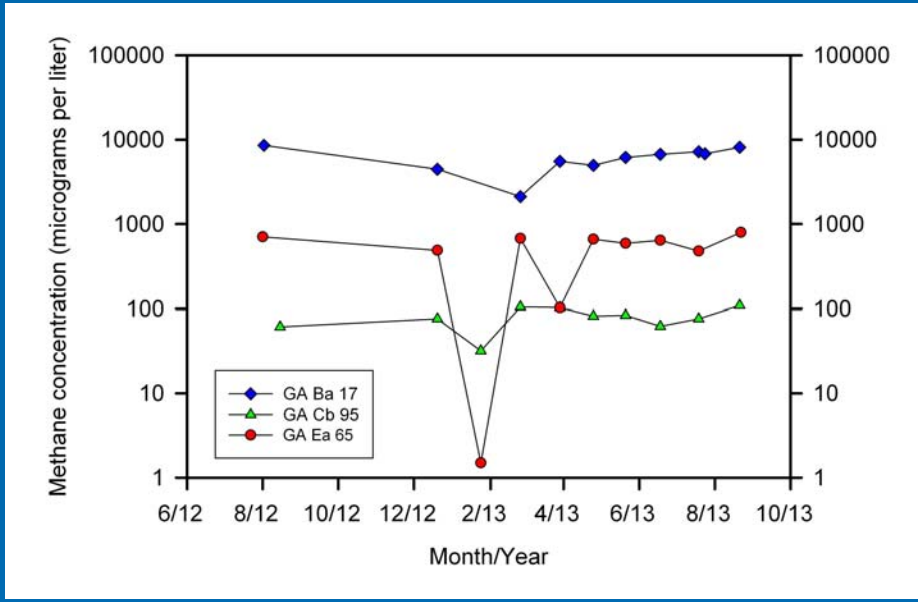
Science: v. 340
DOI: 10.1126/science.1235009

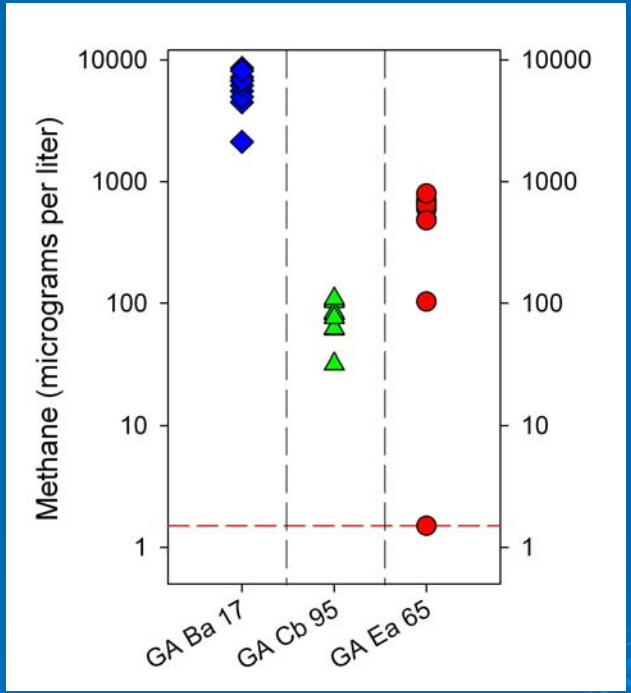
Project asks what's in the water after fracking at depth

S.L. Brantley, J.M., J. Pollak, & R.D. Vidic (2013)

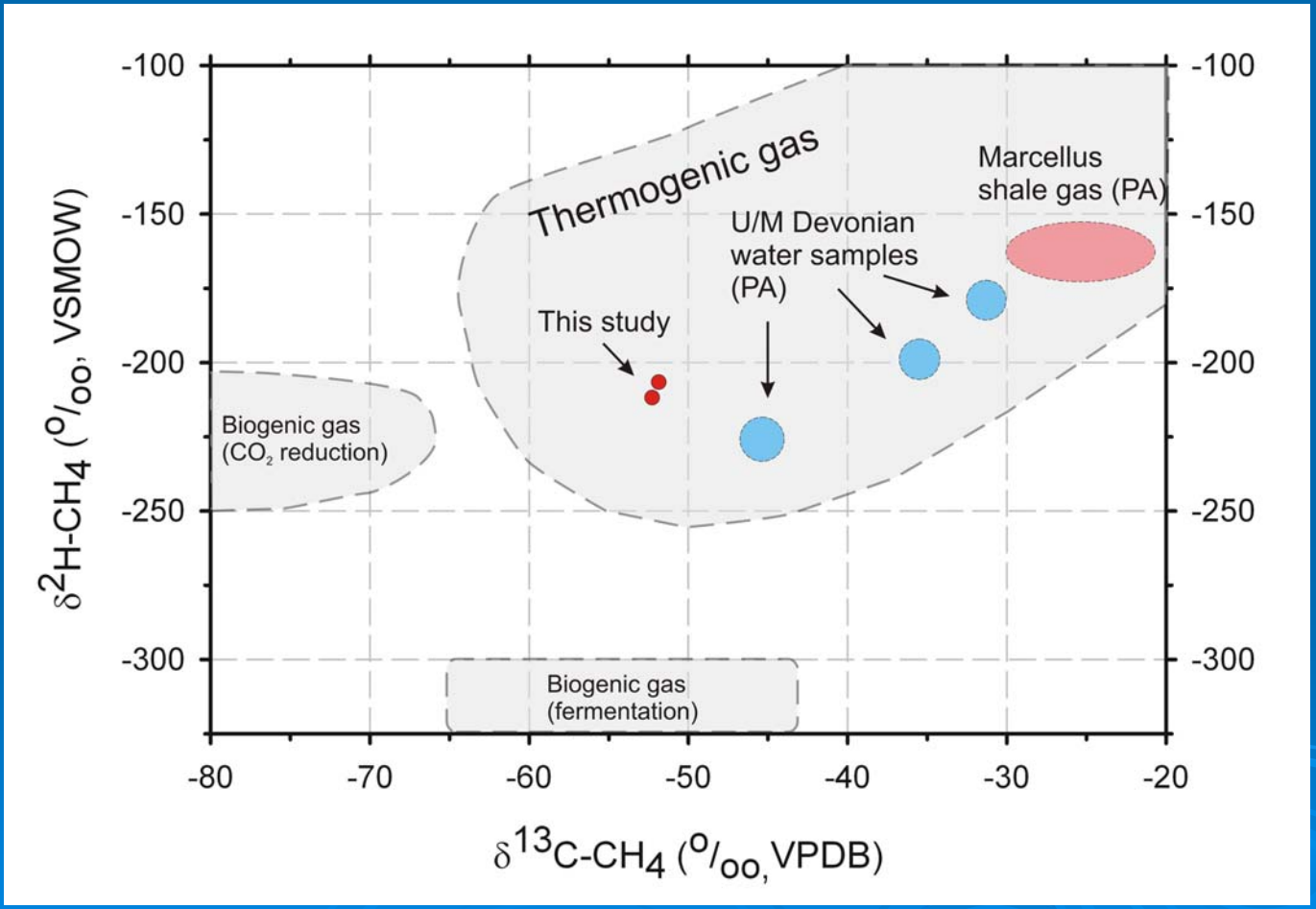
Eos: v. 94, p. 409-411

Monthly methane concentrations collected from three wells





Isotopic signatures: Thermogenic vs biogenic methane?



(modified from Molofsky and others, 2011)

Summary

- Methane was detected in ~44 percent of wells tested. Maximum methane concentration: 8,550 µg/L.
- 4 wells exceeded 1,000 µg/L of dissolved methane. No wells exceeded the 10,000 µg/L (10 mg/L) recommended action level for dissolved methane.
- Methane from wells in coal basins tended to be higher than from wells in non-coal basins.
- Methane from wells located in valleys tended to be higher than from wells located on hilltops or hillsides.
- Monthly methane concentrations varied by 20-30% of median value.
- Isotopic signatures from two samples indicate thermogenic origin for methane.