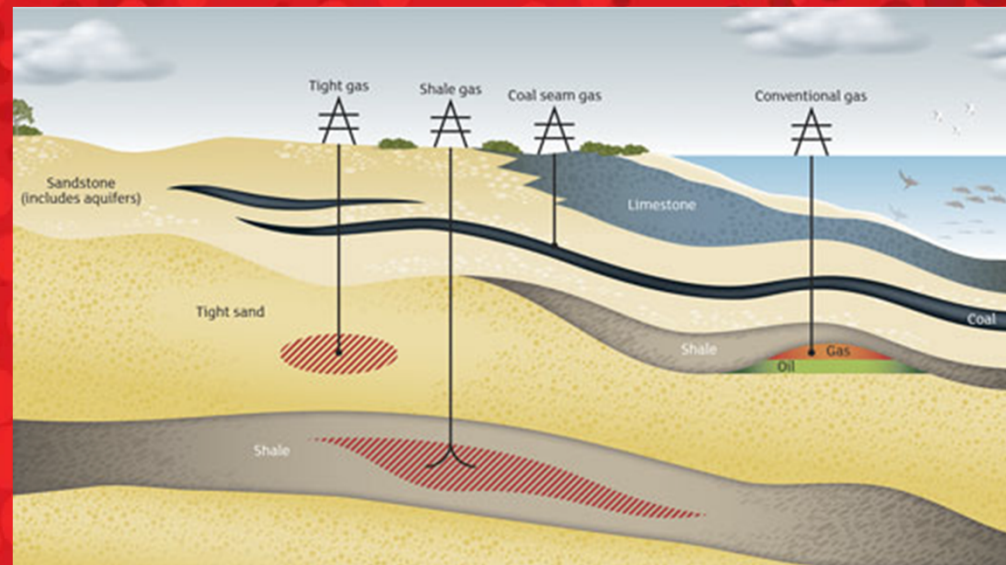


Unconventional gas in Victoria: Potential risks to water & environment



Dr Matthew Currell

School of Civil, Environmental & Chemical Engineering

RMIT University

Melbourne Australia

About me

- PhD (Environmental Geoscience) Monash University (2010)
- Lecturer, School of Civil, Environmental & Chemical Engineering, RMIT University
- Expertise in hydrogeology & geochemistry, particularly groundwater chemistry & quality
- Teach the following courses to 3rd & 4th year Environmental Engineering Students:
Hydrogeology; Advanced Hydrogeology; Land Contamination & Geohazards; China Environment Study Tour.
- Active researcher with >20 peer reviewed publications & project collaborations with:
Melbourne Water, EPA Victoria, Department of Environmental, Land, Water & Planning (DELWP)
- Please note: ***My submission & all views expressed reflect my own academic opinions, and are independent of the current work I am conducting with DELWP Victoria***

Unconventional Gas around the world

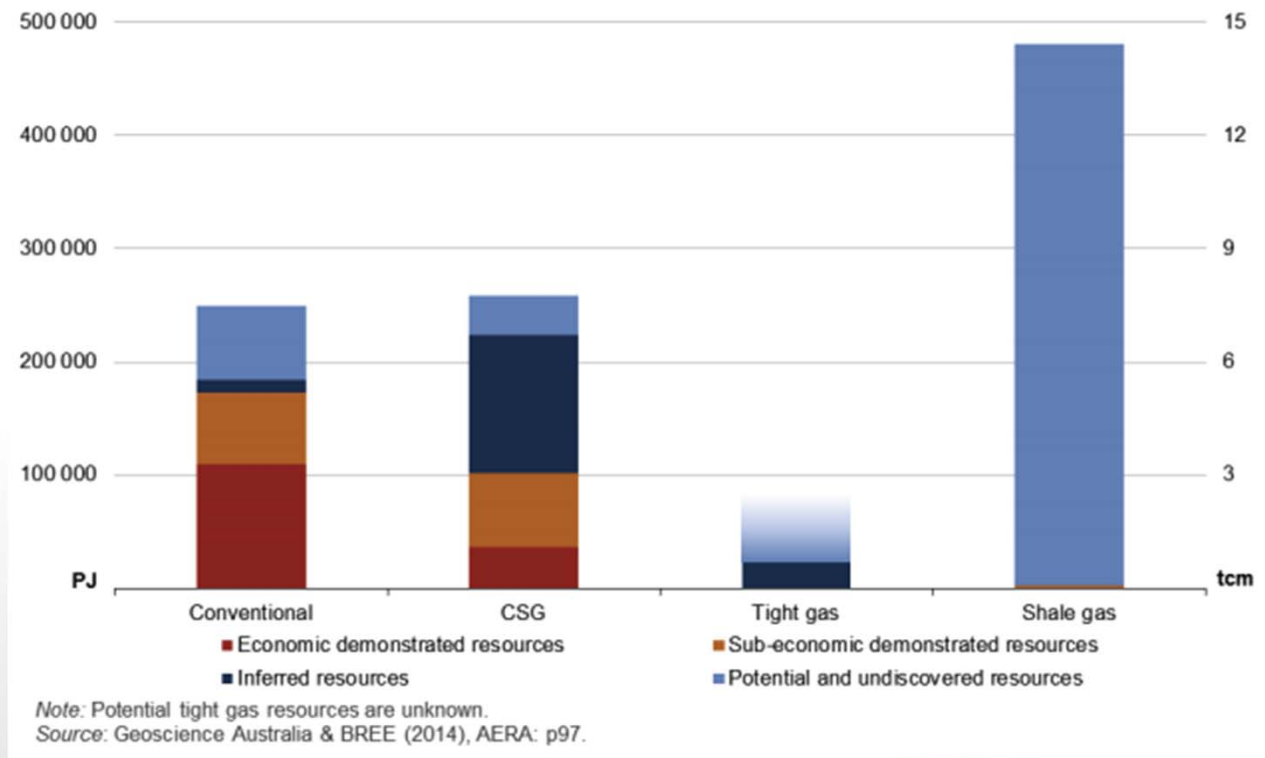
USA

- Rapid growth since early 2000s; 10-20 thousand bores drilled and hydraulically fractured annually (2011 – 2014)
- Shale and tight gas account for 34% and 24% of US natural gas production (2012)
- ~10 million Americans live within 1km of a shale gas well
- US EPA (EPA, 2015) recently completed a thorough review of impacts from unconventional gas on drinking water in the United States. This documented a number of cases of contamination of groundwater in US due to shale gas development, but noted that as yet, widespread negative impacts on drinking water are not evident throughout the country

Unconventional Gas in Australia

Coal seam gas

Queensland: ~7000 active wells; New South Wales: ~250 wells (Q1 2015 Statistics)



Potential risks to water & environment from unconventional gas

Three major risks associated with unconventional gas development are:

1. Risk of increasing the release of **fugitive methane** and other gases into shallow aquifers and/or the atmosphere (has occurred in parts of the United States in areas of intensive shale gas development)
2. Risk of contamination of groundwater or surface water bodies due to **spills or releases of waste water** associated with unconventional gas (has occurred in the United States associated with shale gas and in Australia associated with coal seam gas).
3. Risk of **increasing the connectivity between aquifers**, causing increased cross flow of water and/or contaminants (so far, little evidence of impacts of this nature in areas of unconventional gas, however long term this may be an issue).

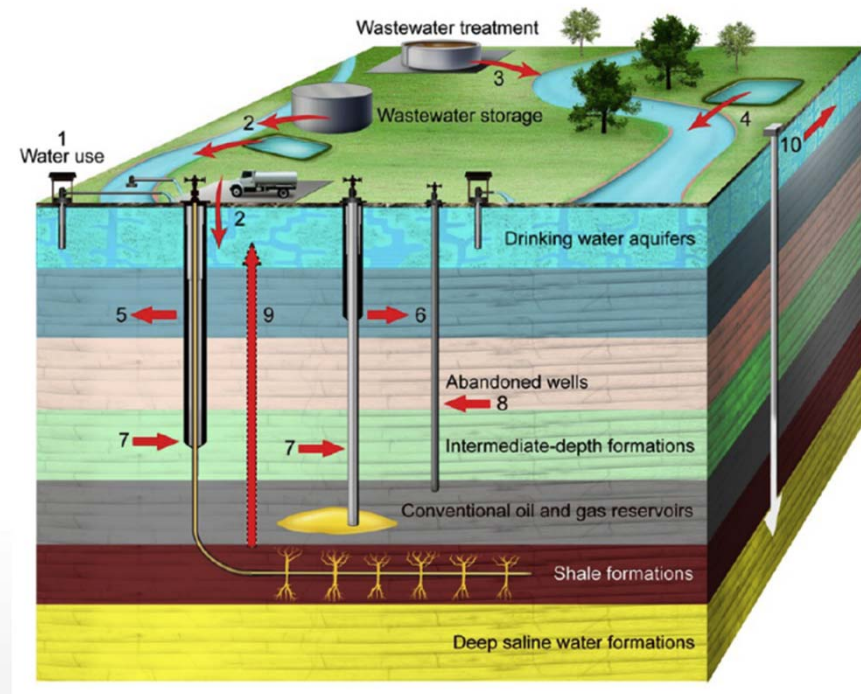
Potential Risks to Groundwater

Groundwater Extraction

- Depletion
- Quality degradation

Groundwater contamination

- Waste/Formation Waters (produced water)
- Fracking Fluid
- Fugitive Gas (mostly methane)



Vengosh et al, 2014 (ES&T)

Lessons to Be Learned from the US

- *Shale gas development moved faster than the science*

Groundwater Protection and Unconventional Gas Extraction: The Critical Need for Field-Based Hydrogeological Research

by R.E. Jackson¹, A.W. Gorody², B. Mayer³, J.W. Roy⁴, M.C. Ryan³, and D.R. Van Stempvoort⁴

Fugitive Methane Impacts

PNAS

Increased stray gas abundance in a subset of drinking water wells near Marcellus shale gas extraction

Robert B. Jackson^{a,b,1}, Avner Vengosh^a, Thomas H. Darrah^a, Nathaniel R. Warner^a, Adrian Down^{a,b}, Robert J. Poreda^c, Stephen G. Osborn^d, Kaiguang Zhao^{a,b}, and Jonathan D. Karr^{a,b}

^aDivision of Earth and Ocean Sciences, Nicholas School of the Environment and ^bCenter on Global Change, Duke University, Durham, NC 27708; ^cDepartment of Earth and Environmental Sciences, University of Rochester, Rochester, NY 14627; and ^dGeological Sciences Department, California State Polytechnic University, Pomona, CA 91768

Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing

Stephen G. Osborn^a, Avner Vengosh^b, Nathaniel R. Warner^b, and Robert B. Jackson^{a,b,c,1}

PNAS

PNAS

Noble gases identify the mechanisms of fugitive gas contamination in drinking-water wells overlying the Marcellus and Barnett Shales

Thomas H. Darrah^{a,b,1}, Avner Vengosh^a, Robert B. Jackson^{a,c}, Nathaniel R. Warner^{a,d}, and Robert J. Poreda^e

^aDivision of Earth and Ocean Sciences, Nicholas School of the Environment, Duke University, Durham, NC 27708; ^bDivisions of Solid Earth Dynamics and Water, Climate and the Environment, School of Earth Sciences, The Ohio State University, Columbus, OH 43210; ^cDepartment of Environmental Earth System Science, School of Earth Sciences, Woods Institute for the Environment, and Precourt Institute for Energy, Stanford University, Stanford, CA 94305; ^dDepartment of Earth Sciences, Dartmouth College, Hanover, NH 03755; and ^eDepartment of Earth and Environmental Sciences, University of Rochester, Rochester, NY 14627

Surface contamination impacts



Article

pubs.acs.org/est

Impacts of Shale Gas Wastewater Disposal on Water Quality in Western Pennsylvania

Nathaniel R. Warner,^{*,†} Cidney A. Christie, Robert B. Jackson, and Avner Vengosh*

Division of Earth and Ocean Sciences, Nicholas School of the Environment, Duke University, Durham, North Carolina 27708, United States



Coal Seam Gas: Produced Water and Solids

Prepared for the Office of the NSW Chief Scientist and Engineer (OCSE)

Never Stand Still

Faculty of Engineering

School of Civil & Environmental Engineering



Image Sources

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