Fracking: How Cheap Energy is Reshaping America’s Environment  
November 5th, 2014

Introduction

The advent of horizontal drilling and hydraulic fracturing, also known as fracking, has led to the development of previously inaccessible resources, significantly increasing world gas and oil reserves. Despite the positive impact on energy reserves, questions about the long-term environmental effects of these extraction methods are unanswered. The technical details involved in fracking and the associated environmental issues will be discussed in this lecture. Fracking is known to cause very small tremors called microseisms. However, larger, more damaging tremors are most often linked to the injection of wastewater from fracking, not to the fracturing process itself. The use of natural gas extracted using fracking techniques - as an energy source instead of coal results in a reduction of carbon dioxide (CO\textsubscript{2}) emissions. However, there is evidence that natural gas extraction results in the emission of methane, a much more potent greenhouse gas than CO\textsubscript{2}. The examination of the environmental effects of hydraulic fracturing presents a host of fascinating issues as complex as they are controversial.

Speakers

Jared Atkinson holds a B.Sc. in Geophysics from the University of Calgary, an M.Sc. in Geophysical Engineering from the Colorado School of Mines, and is currently pursuing a doctorate in Geophysics at MIT. Jared has eight years of experience in the oil and gas industry in both Canada and the US. He has worked on multiple hydraulic fracturing operations and has taught courses on microseismic monitoring of fracture jobs.

Natasha Goss: Natasha Goss is a second-year graduate student studying atmospheric science in the department of Earth and Planetary Sciences at Harvard University. She is from Colorado, which is in the midst of a fracking boom, and did her undergraduate work in Chemistry at the University of Colorado Boulder.

Jordan Wilkerson: Jordan Wilkerson has a B.S. in Chemistry from the University of Central Arkansas and is currently working towards his doctorate in Atmospheric Chemistry at Harvard University. His current research interests pertain to assessing methane emissions in Arctic regions to better understand their present and future contribution to the overall methane budget.
Glossary of Important Terms

Hydrocarbon: an organic compound consisting of hydrogen and carbon

Play: a term used to describe a particular style of hydrocarbon accumulation. Examples include carbonate reef play or shale gas play.

Unconventional: a resource accumulation, or play, that requires additional stimulation, like hydraulic fracturing, to produce hydrocarbons in economic quantities.

Conventional: oil or gas accumulations, or plays, that involve drilling a well into a formation and producing hydrocarbons from the well without having to stimulate the reservoir, increase permeability, or otherwise facilitate production. Examples of conventional methods include sandstone reservoirs, limestone reefs, and salt domes.

Casing: a steel pipe that is cemented in place to keep a drill hole stable and to isolate the well from the surrounding rock.

Frac Fluid: a fluid that is injected into a rock formation to initiate a fracture. It is often composed of water and various chemicals that each have a specific role in the fracturing process.

Proppant: particles of sand or other coarse material that is injected along with the frac fluid into a hydraulic fracture to keep the fracture stably open to the extraction of hydrocarbons.

Wellhead: the system of valves and adapters that is used to control the pressure of the well.

Perfs: perforations made in the casing through the use of an oriented explosive gun which control the direction and concentration of fluid pressure in hydraulic fracturing.

Packers: a device inserted into the well that can expand to seal portions of the drill hole.

Stage: a single interval of hydraulically initiated fractures.

Aquifer: an underground layer of permeable, water-bearing rock from which water can be extracted via a water well.

TCF: trillion cubic feet

Global Warming Potential (GWP): an estimate of how much heat is trapped by a greenhouse gas as compared to the amount trapped by carbon dioxide over a certain period of time (typically over 20, 100, or 200 year timescale)

Resources to learn more

Environmental Protection Agency’s overview of hydraulic fracturing, http://www2.epa.gov/hydraulicfracturing


Upcoming SITN Events

Science by the Pint: Dr. Dimitar Sasselov
“A Weather report from an Exoplanet: Clouds and rain in a place 40 lightyears away”
November 10th at 7pm at The Burren in Davis Square, Cambridge

Fall Lecture Series: “More than a Messenger: The Secret Life of RNA”
November 12th, at 7pm at Harvard Medical School, 200 Longwood Ave. Boston

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