



ONE WORLD,

ONE MEDICINE,

ONE HEALTH

One Health Intellectual Exchange

Weekly Discussions / Course: Philosophy to Practical Integration of Human, Animal and Environmental Health

A weekly discussion series, sponsored by the **North Carolina One Health Collaborative** within the NCBC IEG Program to enhance collaborations between physicians, veterinarians, researchers and other local/global/environmental health professionals by increasing public awareness of the interconnectedness of people, animals and the environment.

(Available each spring for credit if desired)

Wednesday, February 19th, 2014

5:30 – 7:30 p.m.

Water contamination associated with shale gas exploration and hydraulic fracturing in the U.S.

Avner Vengosh, PhD

Professor of Geochemistry and Water Quality
Nicholas School of the Environment, Duke University

Meets Tuesdays, 5:30 – 7:30 p.m. at the North Carolina Biotechnology Center
15 T.W. Alexander Drive Research Triangle Park, NC 27709
Directions: www.ncbiotech.org/directions

Suggestions? Ideas? Contact NC OHC Co-Chairs: Dr. Bill Stokes williamstokes.asg@gmail.com or
Dr. Julie Casani julie.casani@dhhs.nc.gov

Add yourself to the listserv with Listserv Manager Liz Selisker, liz_selisker@ncsu.edu

For Speaker Cancellation notices and additional background on One Health and the NC OHC:

<http://nconehealthcollaborative.weebly.com/index.htm>

<http://onehealtheducation.blogspot.com/>

For more information on the course option contact: Mamie Harris at UNC msharris@med.unc.edu

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Avner Vengosh, PhD

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Avner Vengosh is a Professor of Geochemistry and Water Quality at the Nicholas School of Environment in Duke University. Dr. Vengosh also has a secondary appointment in the Department of Civil and Environmental Engineering at Duke University. He is an Associate Editor for the international journal Applied Geochemistry.

Dr. Vengosh research aims to delineate the sources and pathways of contaminants in the environment and their possible impacts on human health through integration of environmental geochemistry, advanced isotope geochemistry (boron, strontium, carbon, and radium isotopes), and environmental health research (e.g., arsenic in toenails). Currently Dr. Vengosh research is focused on the environmental risks of shale gas exploration and hydraulic fracturing, particularly for evaluation groundwater and surface water contamination and the direct links to shale gas exploration.

In addition, Dr. Vengosh research is engaged in three major themes:

- (1) **The energy-water quality nexus** that includes (i) studies on the impact of coal combustion products on the environment; (ii) the origin of contaminants associated with mountaintop mining in valley-fill head waters in West Virginia; and (iii) the impact of deep shale gas drilling and hydraulic fracturing on the quality of shallow groundwater and surface water (methane and wastewater contamination) from unconventional shale basins in the United States.
- (2) **Environmental health** related to the exposure of population to naturally occurring contaminants (arsenic, fluoride, radioactivity) in drinking water, particularly in rural and developing areas. Studies include developing new diagnostic tools to evaluate their bioaccumulation in the local populations by measuring the contaminants in nails and urine and conducting health surveys in exposed populations. Current studies are in Ethiopia, Vietnam, Morocco, Jordan, and the United States.
- (3) **Salinization of water resources** induced from human activities and climate change. Current studies focused on shallow groundwater in the sub-Saharan basins of Morocco and coastal aquifer of the southeastern United States. Studies also include the geochemistry of “new water” generated by reverse osmosis desalination of seawater and saline groundwater.

For more information on the research and news items from Vengosh’s lab, see:

<http://sites.nicholas.duke.edu/avnervengosh/>

Suggested Readings:

Knodash, A.J., Warner, N.R., Lahav, O., Vengosh, A. (2014) Radium and Barium Removal through Blending Hydraulic Fracturing Fluids with Acid Mine Drainage. *Environmental Science & Technology* (in press). <http://sites.nicholas.duke.edu/avnervengosh/files/2011/08/EST-AMD-HFF-mixing.pdf>

Warner, N.R., Christie, C.A., Jackson, R.B., Vengosh, A. (2013) Impacts of shale gas wastewater disposal on water quality in western Pennsylvania. *Environmental Science & Technology*, 47, 11849–11857 (DOI: 10.1021/es402165b). <http://152.3.12.176/jackson/est2013.pdf>

Jackson, R.B., Vengosh, A., Darrah, T.H., Warner, N.R., Down, A., Poreda, R.J., Osborn, S.G., Zhao, K., and Karr, J.D. (2013) Increased stray gas abundance in a subset of drinking water wells near Marcellus shale gas extraction. *Proceedings of the National Academy of Sciences of United States of America* (June 2013, doi: 10.1073/pnas.1221635110). [Full text](#)

Warner, N.R., Jackson, R.B., Darrah, T.H., Osborn, S.G., Down, A., Zhao, K., White, A., Vengosh, A. (2012). Geochemical evidence for possible natural migration of Marcellus formation brine to shallow aquifers in Pennsylvania. *Proceedings of the National Academy of Sciences of United States of America*. Published online before print July 9, 2012, doi: 10.1073/pnas.1121181109. <http://www.pnas.org/content/109/30/11961.full>

Osborn, S., Vengosh, A., Warner, N., Jackson, R. (2011). Methane contamination of drinking water accompanying gas drilling and hydro-fracking. *Proceedings of the National Academy of Sciences of United States of America*, 108, 8172-8176.

Abstract:

Production from unconventional natural gas reservoirs has substantially expanded in the US through the advent of horizontal drilling and high-volume hydraulic fracturing. These technological advances have opened vast new energy sources, such as low-permeability organic-rich shale formations and “tight-sand” reservoirs, altering the domestic energy landscape in the United States. Despite the large resource potentials and economic benefits, the rapid expansion of shale gas development in the U.S. has triggered an intense public debate over the environmental and human health implications of unconventional energy development, and particularly on contamination of water resources near exploration sites. As part of the One Health Intellectual Exchange Group discussion, highlights of recent Duke University research on shale gas and hydraulic fracturing will be presented. The discussion will include studies on stray gas contamination in shallow drinking water wells located near shale gas drilling sites with super-saturation of methane in water, studies on the occurrence of contaminants and radioactive materials in hydraulic fracturing fluids and sites of wastewater disposal and/or spills, and seeking alternative water source for hydraulic fracturing such as marginal water resources (e.g., acid mine drainage).

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