

Submitted Testimony

Bibliography of Peer-Reviewed Articles Pertaining to Health-Related Implications of Shale Gas Development

February 3, 2014

Compiled by Physicians Scientists & Engineers for Healthy Energy

PSE Healthy Energy is committed to bringing scientific transparency to energy policy issues and empowering citizens and policymakers by generating, translating, and disseminating objective, evidence-based scientific information on important energy policy choices.

Contact Jake Hays (hays@psehealthyenergy.org) for further information or copies.

This bibliography contains 145 articles. **More than half have been published in the last year**, demonstrating the recent rapid expansion of research.

The bibliography is divided into the following topics:

Health Studies Specific to Shale Gas

28 articles; 16 published 2013/14; 22 published since 2012

Air Quality

22 articles; 9 published 2013/14; 15 published since 2012

Climate

12 articles; 8 published 2013/14; 12 published since 2012

Health Studies Relevant to Shale Gas

30 articles; 19 published 2013/14; 24 published since 2012

Radiation

3 articles; 1 published 2013/14; 3 published since 2012

Wastewater

12 articles; 9 published 2013/14; 11 published since 2012

Water Quality

38 articles; 21 published 2013/14; 28 published since 2012

Bibliography of Peer-Reviewed Articles Pertaining to Health-Related
Implications of Shale Gas Development
[Pick the date]

Health Studies Specific to Shale Gas

- Bamberger, Michelle, and Robert E. Oswald. "Impacts of Gas Drilling on Human and Animal Health." *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy* 22.1 (2012): 51–77. *CrossRef*. Web. 5 June 2013.
- Chalupka, Stephanie. "Occupational Silica Exposure in Hydraulic Fracturing." *Workplace health & safety* 60.10 (2012): 460. *NCBI PubMed*. Web.
- Colborn, Theo et al. "Natural Gas Operations from a Public Health Perspective." *Human and Ecological Risk Assessment: An International Journal* 17.5 (2011): 1039–1056. *Taylor and Francis+NEJM*. Web. 5 June 2013.
- Esswein, Eric J et al. "Occupational Exposures to Respirable Crystalline Silica during Hydraulic Fracturing." *Journal of occupational and environmental hygiene* 10.7 (2013): 347–356. *NCBI PubMed*. Web.
- Ferrar, Kyle J et al. "Assessment and Longitudinal Analysis of Health Impacts and Stressors Perceived to Result from Unconventional Shale Gas Development in the Marcellus Shale Region." *International Journal of Occupational and Environmental Health* 19.2 (2013): 104–112. *IngentaConnect*. Web.
- Finkel, M.L., and J. Hays. "The Implications of Unconventional Drilling for Natural Gas: A Global Public Health Concern." *Public Health* 127.10 (2013): 889–893. *CrossRef*. Web. 2 Feb. 2014.
- Finkel, Madelon, Jake Hays, and Adam Law. "The Shale Gas Boom and the Need for Rational Policy." *American Journal of Public Health* (2013): e1–e3. *CrossRef*. Web. 5 June 2013.
- Finkel, Madelon L, and Adam Law. "The Rush to Drill for Natural Gas: A Public Health Cautionary Tale." *American journal of public health* 101.5 (2011): 784–785. *NCBI PubMed*. Web.
- Finkel, Madelon L., Jake Hays, and Adam Law. "Modern Natural Gas Development and Harm to Health: The Need for Proactive Public Health Policies." *ISRN Public Health* 2013 (2013): 1–5. *CrossRef*. Web. 13 June 2013.
- Goldstein, Bernard D. "The Importance of Public Health Agency Independence: Marcellus Shale Gas Drilling in Pennsylvania." *American journal of public health* 104.2 (2014): e13–15. *NCBI PubMed*. Web.
- Goldstein, Bernard D., Jill Kriesky, and Barbara Pavliakova. "Missing from the Table: Role of the Environmental Public Health Community in Governmental Advisory Commissions Related to Marcellus Shale Drilling." *Environmental Health Perspectives* 120.4 (2012): 483–486. *PubMed Central*. Web. 5 June 2013.
- Kaktins, Nina M. "Drilling the Marcellus Shale for Natural Gas: Environmental Health Issues for Nursing." *The Pennsylvania nurse* 66.1 (2011): 4–8; quiz 8–9. Print.
- Kassotis, C. D. et al. "Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region." *Endocrinology* (2013): n. pag. *CrossRef*. Web. 17 Jan. 2014.
- Korfmacher, Katrina Smith et al. "Public Health and High Volume Hydraulic Fracturing." *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy* 23.1 (2013): 13–31. *CrossRef*. Web. 12 June 2013.
- Lauver, Lori S. "Environmental Health Advocacy: An Overview of Natural Gas Drilling in Northeast Pennsylvania and Implications for Pediatric Nursing." *Journal of pediatric nursing* 27.4 (2012): 383–389. *NCBI PubMed*. Web.
- Mackie, P, C Johnman, and F Sim. "Hydraulic Fracturing: A New Public Health Problem 138 Years in the Making?" *Public health* 127.10 (2013): 887–888. *NCBI PubMed*. Web.
- McDermott-Levy, By Ruth, Nina Kaktins, and Barbara Sattler. "Fracking, the Environment, and Health." *AJN, American Journal of Nursing* 113.6 (2013): 45–51. *CrossRef*. Web. 20 June 2013.
- McDermott-Levy, Ruth, and Nina Kaktins. "Preserving Health in the Marcellus Region." *The Pennsylvania nurse* 67.3 (2012): 4–10; quiz 11–12. Print.

Bibliography of Peer-Reviewed Articles Pertaining to Health-Related Implications of Shale Gas Development

[Pick the date]

- McKenzie, Lisa M. et al. "Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado." *Environmental Health Perspectives* (2014): n. pag. *CrossRef*. Web. 30 Jan. 2014.
- Mode, N. A., and G. A. Conway. "Fatalities Among Oil and Gas Extraction Workers - United States, 2003-2006." *MMWR. Morbidity and Mortality Weekly Report* (2008): n. pag. *www.highbeam.com*. Web. 7 June 2013.
- Perry, Simona L. "Using Ethnography to Monitor the Community Health Implications of Onshore Unconventional Oil and Gas Developments: Examples from Pennsylvania's Marcellus Shale." *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy* 23.1 (2013): 33-53. *CrossRef*. Web. 12 June 2013.
- Rafferty, Margaret A, and Elena Limonik. "Is Shale Gas Drilling an Energy Solution or Public Health Crisis?" *Public health nursing (Boston, Mass.)* 30.5 (2013): 454-462. *NCBI PubMed*. Web.
- Rojas-Rueda, David. "[Public health effects of fracking (gas extraction through hydraulic fracturing) in Spain]." *Gaceta sanitaria / S.E.S.P.A.S* 27.4 (2013): 382. *NCBI PubMed*. Web.
- Saberi, Pouné. "Navigating Medical Issues in Shale Territory." *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy* 23.1 (2013): 209-221. *CrossRef*. Web. 12 June 2013.
- Schmidt, Charles W. "Blind Rush? Shale Gas Boom Proceeds Amid Human Health Questions." *Environmental Health Perspectives* 119.8 (2011): a348-a353. *PubMed Central*. Web. 5 June 2013.
- Sewell, C. M et al. "TESTICULAR CANCER AND EMPLOYMENT IN AGRICULTURE AND OIL AND NATURAL GAS EXTRACTION." *The Lancet* 327.8480 (1986): 553. *ScienceDirect*. Web. 23 Jan. 2014.
- Steinzor, Nadia, Wilma Subra, and Lisa Sumi. "Investigating Links between Shale Gas Development and Health Impacts Through a Community Survey Project in Pennsylvania." *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy* 23.1 (2013): 55-83. *CrossRef*. Web. 12 June 2013.
- Witter, Roxana Z et al. "The Use of Health Impact Assessment for a Community Undergoing Natural Gas Development." *American journal of public health* 103.6 (2013): 1002-1010. *NCBI PubMed*. Web.

Air Quality

- Allen, David T. et al. "Measurements of Methane Emissions at Natural Gas Production Sites in the United States." *Proceedings of the National Academy of Sciences* (2013): 201304880. *www.pnas.org*. Web. 10 Oct. 2013.
- Colborn, Theo et al. "An Exploratory Study of Air Quality near Natural Gas Operations." *Human and Ecological Risk Assessment: An International Journal* 0.ja (2012): null. *Taylor and Francis+NEJM*. Web. 5 June 2013.
- Haberzettl, Petra et al. "Exposure to Ambient Air Fine Particulate Matter Prevents VEGF-Induced Mobilization of Endothelial Progenitor Cells from the Bone Marrow." *Environmental health perspectives* 120.6 (2012): 848-856. *NCBI PubMed*. Web.
- Holguin, Fernando et al. "Traffic-Related Exposures, Airway Function, Inflammation, and Respiratory Symptoms in Children." *American journal of respiratory and critical care medicine* 176.12 (2007): 1236-1242. *NCBI PubMed*. Web.
- Jackson, Robert B et al. "Natural Gas Pipeline Leaks Across Washington, DC." *Environmental science & technology* (2014): n. pag. *NCBI PubMed*. Web.
- Jerrett, Michael et al. "Long-Term Ozone Exposure and Mortality." *New England Journal of Medicine* 360.11 (2009): 1085-1095. *Taylor and Francis+NEJM*. Web. 5 June 2013.
- Karion, Anna et al. "Methane Emissions Estimate from Airborne Measurements over a Western United States Natural Gas Field." *Geophysical Research Letters* (2013): n/a-n/a. *Wiley Online Library*. Web. 6 Aug. 2013.

Bibliography of Peer-Reviewed Articles Pertaining to Health-Related Implications of Shale Gas Development

[Pick the date]

- Katzenstein, Aaron S. et al. "Extensive Regional Atmospheric Hydrocarbon Pollution in the Southwestern United States." *Proceedings of the National Academy of Sciences* 100.21 (2003): 11975–11979. www.pnas.org. Web. 11 June 2013.
- Kemball-Cook, Susan et al. "Ozone Impacts of Natural Gas Development in the Haynesville Shale." *Environmental Science & Technology* 44.24 (2010): 9357–9363. *ACS Publications*. Web. 5 June 2013.
- Litovitz, Aviva et al. "Estimation of Regional Air-Quality Damages from Marcellus Shale Natural Gas Extraction in Pennsylvania." *Environmental Research Letters* 8.1 (2013): 014017. *Institute of Physics*. Web. 5 June 2013.
- McKenzie, Lisa M et al. "Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources." *The Science of the total environment* 424 (2012): 79–87. *NCBI PubMed*. Web.
- Olague, Eduardo P. "The Potential near-Source Ozone Impacts of Upstream Oil and Gas Industry Emissions." *Journal of the Air & Waste Management Association (1995)* 62.8 (2012): 966–977. Print.
- Pacsi, Adam P et al. "Regional Air Quality Impacts of Increased Natural Gas Production and Use in Texas." *Environmental science & technology* 47.7 (2013): 3521–3527. *NCBI PubMed*. Web.
- Peischl, J. et al. "Quantifying Sources of Methane Using Light Alkanes in the Los Angeles Basin, California." *Journal of Geophysical Research: Atmospheres* 118.10 (2013): 4974–4990. *Wiley Online Library*. Web. 7 Aug. 2013.
- Pétron, Gabrielle et al. "Hydrocarbon Emissions Characterization in the Colorado Front Range: A Pilot Study." *Journal of Geophysical Research: Atmospheres* 117.D4 (2012): n/a–n/a. *Wiley Online Library*. Web. 5 June 2013.
- Phillips, Nathan G. et al. "Mapping Urban Pipeline Leaks: Methane Leaks across Boston." *Environmental Pollution* 173 (2013): 1–4. *ScienceDirect*. Web. 7 Aug. 2013.
- Pope, C. Arden et al. "Cardiovascular Mortality and Long-Term Exposure to Particulate Air Pollution Epidemiological Evidence of General Pathophysiological Pathways of Disease." *Circulation* 109.1 (2004): 71–77. circ.ahajournals.org. Web. 5 June 2013.
- Roy, Anirban A., Peter J. Adams, and Allen L. Robinson. "Air Pollutant Emissions from the Development, Production, and Processing of Marcellus Shale Natural Gas." *Journal of the Air & Waste Management Association* 64.1 (2014): 19–37. *Taylor and Francis+NEJM*. Web. 17 Jan. 2014.
- Schnell, Russell C. et al. "Rapid Photochemical Production of Ozone at High Concentrations in a Rural Site during Winter." *Nature Geoscience* 2.2 (2009): 120–122. www.nature.com. Web. 5 June 2013.
- Simpson, Isobel J. et al. "Air Quality in the Industrial Heartland of Alberta, Canada and Potential Impacts on Human Health." *Atmospheric Environment* 81 (2013): 702–709. *ScienceDirect*. Web. 30 Jan. 2014.
- Slama, Remy et al. "Maternal Personal Exposure to Airborne Benzene and Intrauterine Growth." *Environmental Health Perspectives* 117.8 (2009): 1313–1321. *PubMed Central*. Web. 5 June 2013.
- Weinhold, Bob. "The Future of Fracking: New Rules Target Air Emissions for Cleaner Natural Gas Production." *Environmental Health Perspectives* 120.7 (2012): a272–a279. *PubMed Central*. Web. 23 Jan. 2014.

Climate

- Dale, Alexander T et al. "Process Based Life-Cycle Assessment of Natural Gas from the Marcellus Shale." *Environmental science & technology* 47.10 (2013): 5459–5466. *NCBI PubMed*. Web.

Bibliography of Peer-Reviewed Articles Pertaining to Health-Related Implications of Shale Gas Development

[Pick the date]

- Hayhoe, Katharine et al. "Substitution of Natural Gas for Coal: Climatic Effects of Utility Sector Emissions." *Climatic Change* 54.1-2 (2002): 107–139. *link.springer.com*. Web. 10 Oct. 2013.
- Howarth, Robert W., Renee Santoro, and Anthony Ingraffea. "Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations." *Climatic Change* 106.4 (2011): 679–690. *link.springer.com*. Web. 5 June 2013.
- Howarth, Robert W., Renee Santoro, and Anthony Ingraffea. "Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et Al." *Climatic Change* 113.2 (2012): 537–549. *link.springer.com*. Web. 5 June 2013.
- Jiang, Mohan et al. "Life Cycle Greenhouse Gas Emissions of Marcellus Shale Gas." *Environmental Research Letters* 6.3 (2011): 034014. *Institute of Physics*. Web. 18 July 2013.
- Laurenzi, Ian J, and Gilbert R Jersey. "Life Cycle Greenhouse Gas Emissions and Freshwater Consumption of Marcellus Shale Gas." *Environmental science & technology* 47.9 (2013): 4896–4903. *NCBI PubMed*. Web.
- Miller, Scot M. et al. "Anthropogenic Emissions of Methane in the United States." *Proceedings of the National Academy of Sciences* 110.50 (2013): 20018–20022. *www.pnas.org*. Web. 23 Jan. 2014.
- Myhrvold, N. P., and K. Caldeira. "Greenhouse Gases, Climate Change and the Transition from Coal to Low-Carbon Electricity." *Environmental Research Letters* 7.1 (2012): 014019. *Institute of Physics*. Web. 23 Jan. 2014.
- Patz, Jonathan et al. "Health Impact Assessment of Global Climate Change: Expanding on Comparative Risk Assessment Approaches for Policy Making." *Annual review of public health* 29 (2008): 27–39. *NCBI PubMed*. Web.
- Shindell, Drew T. et al. "Improved Attribution of Climate Forcing to Emissions." *Science* 326.5953 (2009): 716–718. *www.sciencemag.org*. Web. 5 June 2013.
- Stephenson, Eleanor, Alexander Doukas, and Karena Shaw. "Greenwashing Gas: Might a 'transition Fuel' Label Legitimize Carbon-Intensive Natural Gas Development?" *Energy Policy* 46 (2012): 452–459. *ScienceDirect*. Web. 23 Jan. 2014.
- Stephenson, Trevor, Jose Eduardo Valle, and Xavier Riera-Palou. "Modeling the Relative GHG Emissions of Conventional and Shale Gas Production." *Environmental Science & Technology* 45.24 (2011): 10757–10764. *PubMed Central*. Web. 23 Jan. 2014.

Health Studies Relevant to Shale Gas

- Bell, Michelle L. et al. "Climate Change, Ambient Ozone, and Health in 50 US Cities." *Climatic Change* 82.1-2 (2007): 61–76. *CrossRef*. Web. 5 June 2013.
- Carpenter, David O, and Sheila Bushkin-Bedient. "Exposure to Chemicals and Radiation during Childhood and Risk for Cancer Later in Life." *The Journal of adolescent health: official publication of the Society for Adolescent Medicine* 52.5 Suppl (2013): S21–29. *NCBI PubMed*. Web.
- Chang, Howard H., Jingwen Zhou, and Montserrat Fuentes. "Impact of Climate Change on Ambient Ozone Level and Mortality in Southeastern United States." *International Journal of Environmental Research and Public Health* 7.7 (2010): 2866–2880. *PubMed Central*. Web. 5 June 2013.
- Chang, Yu-Kang et al. "The Short-Term Effects of Air Pollution on Adolescent Lung Function in Taiwan." *Chemosphere* 87.1 (2012): 26–30. *NCBI PubMed*. Web.
- Costello, Anthony et al. "Managing the Health Effects of Climate Change." *The Lancet* 373.9676 (2009): 1693–1733. *CrossRef*. Web. 7 June 2013.
- Couraud, SeBastien et al. "Lung Cancer in Never Smokers - A Review." *European Journal of Cancer* 48.9 (2012): 1299.
- Finkel, Madelon L., Jake Hays, and Adam Law. "Modern Natural Gas Development and Harm to Health: The Need for Proactive Public Health Policies." *ISRN Public Health* (2013): n. pag. *ProQuest*. Web. 31 Jan. 2014.

Bibliography of Peer-Reviewed Articles Pertaining to Health-Related Implications of Shale Gas Development

[Pick the date]

- Glass, Deborah C et al. "Leukemia Risk Associated with Low-Level Benzene Exposure." *Epidemiology (Cambridge, Mass.)* 14.5 (2003): 569–577. *NCBI PubMed. Web.*
- Glinianaia, Svetlana V et al. "Particulate Air Pollution and Fetal Health: A Systematic Review of the Epidemiologic Evidence." *Epidemiology (Cambridge, Mass.)* 15.1 (2004): 36–45. *NCBI PubMed. Web.*
- Haberzettl, Petra et al. "Exposure to Ambient Air Fine Particulate Matter Prevents VEGF-Induced Mobilization of Endothelial Progenitor Cells from the Bone Marrow." *Environmental health perspectives* 120.6 (2012): 848–856. *NCBI PubMed. Web.*
- Holguin, Fernando et al. "Traffic-Related Exposures, Airway Function, Inflammation, and Respiratory Symptoms in Children." *American journal of respiratory and critical care medicine* 176.12 (2007): 1236–1242. *NCBI PubMed. Web.*
- Jerrett, Michael et al. "Long-Term Ozone Exposure and Mortality." *New England Journal of Medicine* 360.11 (2009): 1085–1095. *Taylor and Francis+NEJM. Web.* 5 June 2013.
- Landrigan, Philip J., and Lynn R. Goldman. "Children's Vulnerability To Toxic Chemicals: A Challenge And Opportunity To Strengthen Health And Environmental Policy." *Health Affairs* 30.5 (2011): 842–850. *content.healthaffairs.org. Web.* 5 June 2013.
- Lupo, Philip J. et al. "Maternal Exposure to Ambient Levels of Benzene and Neural Tube Defects among Offspring: Texas, 1999-2004." *Environmental Health Perspectives* 119.3 (2011): 397–402. *PubMed Central. Web.* 5 June 2013.
- Manney, Sarah et al. "Association between Exhaled Breath Condensate Nitrate + Nitrite Levels with Ambient Coarse Particle Exposure in Subjects with Airways Disease." *Occupational and environmental medicine* 69.9 (2012): 663–669. *NCBI PubMed. Web.*
- McDONALD, J. Corbett et al. "Mortality from Lung and Kidney Disease in a Cohort of North American Industrial Sand Workers: An Update." *Annals of Occupational Hygiene* 49.5 (2005): 367–373. *annhyg.oxfordjournals.org. Web.* 7 June 2013.
- McMichael, Anthony J, Rosalie E Woodruff, and Simon Hales. "Climate Change and Human Health: Present and Future Risks." *The Lancet* 367.9513 (2006): 859–869. *CrossRef. Web.* 5 June 2013.
- Medina-Ramón, Mercedes, and Joel Schwartz. "Who Is More Vulnerable to Die from Ozone Air Pollution?" *Epidemiology (Cambridge, Mass.)* 19.5 (2008): 672–679. *NCBI PubMed. Web.*
- Peng, Roger D. et al. "Emergency Admissions for Cardiovascular and Respiratory Diseases and the Chemical Composition of Fine Particle Air Pollution." *Environmental Health Perspectives* 117.6 (2009): 957–963. *PubMed Central. Web.* 7 June 2013.
- Pope, C. Arden et al. "Cardiovascular Mortality and Long-Term Exposure to Particulate Air Pollution Epidemiological Evidence of General Pathophysiological Pathways of Disease." *Circulation* 109.1 (2004): 71–77. *circ.ahajournals.org. Web.* 5 June 2013.
- Pope III C, Burnett RT. "Lung Cancer, Cardiopulmonary Mortality, and Long-Term Exposure to Fine Particulate Air Pollution." *JAMA* 287.9 (2002): 1132–1141. *Silverchair. Web.* 5 June 2013.
- Salam, Muhammad T et al. "Birth Outcomes and Prenatal Exposure to Ozone, Carbon Monoxide, and Particulate Matter: Results from the Children's Health Study." *Environmental health perspectives* 113.11 (2005): 1638–1644. *Print.*
- Salam, Muhammad T. et al. "Birth Outcomes and Prenatal Exposure to Ozone, Carbon Monoxide, and Particulate Matter: Results from the Children's Health Study." *Environmental Health Perspectives* 113.11 (2005): 1638–1644. *JSTOR. Web.* 31 Jan. 2014.
- Slama, Remy et al. "Maternal Personal Exposure to Airborne Benzene and Intrauterine Growth." *Environmental Health Perspectives* 117.8 (2009): 1313–1321. *PubMed Central. Web.* 5 June 2013.
- Suwanwaiphatthana, Wiparat, Kannika Ruangdej, and Anne Turner-Henson. "Outdoor Air Pollution and Children's Health." *Pediatric nursing* 36.1 (2010): 25–32. *Print.*
- Turner, Michelle C et al. "Long-Term Ambient Fine Particulate Matter Air Pollution and Lung Cancer in a Large Cohort of Never-Smokers." *American journal of respiratory and critical care medicine* 184.12 (2011): 1374–1381. *NCBI PubMed. Web.*

Bibliography of Peer-Reviewed Articles Pertaining to Health-Related Implications of Shale Gas Development

[Pick the date]

- Tzivian, Lilian. "Outdoor Air Pollution and Asthma in Children." *The Journal of asthma: official journal of the Association for the Care of Asthma* 48.5 (2011): 470–481. *NCBI PubMed*. Web.
- Villeneuve, Paul J et al. "Short-Term Effects of Ambient Air Pollution on Stroke: Who Is Most Vulnerable?" *The Science of the total environment* 430 (2012): 193–201. *NCBI PubMed*. Web.
- Volk, Heather E et al. "Traffic-Related Air Pollution, Particulate Matter, and Autism." *JAMA psychiatry* 70.1 (2013): 71–77. *NCBI PubMed*. Web.
- Whitworth, Kristina W., Elaine Symanski, and Ann L. Coker. "Childhood Lymphohematopoietic Cancer Incidence and Hazardous Air Pollutants in Southeast Texas, 1995-2004." *Environmental Health Perspectives* 116.11 (2008): 1576–1580. *PubMed Central*. Web. 5 June 2013.

Radiation

- Kondash, Andrew J et al. "Radium and Barium Removal through Blending Hydraulic Fracturing Fluids with Acid Mine Drainage." *Environmental science & technology* 48.2 (2014): 1334–1342. *NCBI PubMed*. Web.
- Luo, Haohan et al. "Radioactive Elements in Natural Gas: A Case Study on Distribution of Gaseous ²²²Rn and Its Origin Mechanism." *Natural Hazards* 63.2 (2012): 647–657. *link.springer.com*. Web. 31 Jan. 2014.
- Walter, Gary R., Roland R. Benke, and David A. Pickett. "Effect of Biogas Generation on Radon Emissions from Landfills Receiving Radium-Bearing Waste from Shale Gas Development." *Journal of the Air & Waste Management Association* 62.9 (2012): 1040–1049. *Taylor and Francis+NEJM*. Web. 31 Jan. 2014.

Wastewater

- Alley, Bethany et al. "Chemical and Physical Characterization of Produced Waters from Conventional and Unconventional Fossil Fuel Resources." *Chemosphere* 85.1 (2011): 74–82. *ScienceDirect*. Web. 5 June 2013.
- Balaba, Ronald S, and Ronald B Smart. "Total Arsenic and Selenium Analysis in Marcellus Shale, High-Salinity Water, and Hydrofracture Flowback Wastewater." *Chemosphere* 89.11 (2012): 1437–1442. *NCBI PubMed*. Web.
- Barbot, Elise et al. "Spatial and Temporal Correlation of Water Quality Parameters of Produced Waters from Devonian-Age Shale Following Hydraulic Fracturing." *Environmental science & technology* 47.6 (2013): 2562–2569. *NCBI PubMed*. Web.
- Dahm, Katharine G et al. "Identifying Well Contamination through the Use of 3-D Fluorescence Spectroscopy to Classify Coalbed Methane Produced Water." *Environmental science & technology* 47.1 (2013): 649–656. *NCBI PubMed*. Web.
- Ferrar, Kyle J et al. "Assessment of Effluent Contaminants from Three Facilities Discharging Marcellus Shale Wastewater to Surface Waters in Pennsylvania." *Environmental science & technology* 47.7 (2013): 3472–3481. *NCBI PubMed*. Web.
- Haluszczak, Lara O., Arthur W. Rose, and Lee R. Kump. "Geochemical Evaluation of Flowback Brine from Marcellus Gas Wells in Pennsylvania, USA." *Applied Geochemistry* 28 (2013): 55–61. *ScienceDirect*. Web. 2 Oct. 2013.
- Jiang, Mohan, Chris T Hendrickson, and Jeanne M Vanbriesen. "Life Cycle Water Consumption and Wastewater Generation Impacts of a Marcellus Shale Gas Well." *Environmental science & technology* (2014): n. pag. *NCBI PubMed*. Web.
- Kondash, Andrew J et al. "Radium and Barium Removal through Blending Hydraulic Fracturing Fluids with Acid Mine Drainage." *Environmental science & technology* 48.2 (2014): 1334–1342. *NCBI PubMed*. Web.

Bibliography of Peer-Reviewed Articles Pertaining to Health-Related Implications of Shale Gas Development

[Pick the date]

- Murali Mohan, Arvind et al. "Microbial Community Changes in Hydraulic Fracturing Fluids and Produced Water from Shale Gas Extraction." *Environmental science & technology* 47.22 (2013): 13141–13150. *NCBI PubMed*. Web.
- Rich, Alisa L., and Ernest C. Crosby. "Analysis of Reserve Pit Sludge from Unconventional Natural Gas Hydraulic Fracturing and Drilling Operations for the Presence of Technologically Enhanced Naturally Occurring Radioactive Material (TENORM)." *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy* 23.1 (2013): 117–135. *CrossRef*. Web. 12 June 2013.
- Walter, Gary R, Roland R Benke, and David A Pickett. "Effect of Biogas Generation on Radon Emissions from Landfills Receiving Radium-Bearing Waste from Shale Gas Development." *Journal of the Air & Waste Management Association (1995)* 62.9 (2012): 1040–1049. Print.
- Warner, Nathaniel R. et al. "Impacts of Shale Gas Wastewater Disposal on Water Quality in Western Pennsylvania." *Environmental Science & Technology* (2013): n. pag. *ACS Publications*. Web. 2 Oct. 2013.

Water Quality

- Art Bonett, and Demos Pafitis. "Getting to the Root of Gas Migration." 1996.
- Claudio Brufatto et al. *From Mud to Cement - Building Gas Wells*. N. p., 2003. *Oilfield Review*.
- Dahm, Katharine G et al. "Identifying Well Contamination through the Use of 3-D Fluorescence Spectroscopy to Classify Coalbed Methane Produced Water." *Environmental science & technology* 47.1 (2013): 649–656. *NCBI PubMed*. Web.
- Davies, Richard J. "Methane Contamination of Drinking Water Caused by Hydraulic Fracturing Remains Unproven." *Proceedings of the National Academy of Sciences* 108.43 (2011): E871–E871. *www.pnas.org*. Web. 18 June 2013.
- DiGiulio, Dominic C. et al. *Investigation of Ground Water Contamination near Pavillion, Wyoming*. Pavillion, WY: U.S. Environmental Protection Agency, 2011.
- Entrekin, Sally et al. "Rapid Expansion of Natural Gas Development Poses a Threat to Surface Waters." *Frontiers in Ecology and the Environment* 9.9 (2011): 503–511. *ESA Journals*. Web. 23 Jan. 2014.
- . "Rapid Expansion of Natural Gas Development Poses a Threat to Surface Waters." *Frontiers in Ecology and the Environment* 9.9 (2011): 503–511. *ESA Journals*. Web. 31 Jan. 2014.
- Ewers, U, B Gordalla, and F Frimmel. "[Hydraulic fracturing - a hazard for drinking water?]." *Gesundheitswesen (Bundesverband der Ärzte des Öffentlichen Gesundheitsdienstes (Germany))* 75.11 (2013): 735–741. *NCBI PubMed*. Web.
- Ferrar, Kyle J et al. "Assessment of Effluent Contaminants from Three Facilities Discharging Marcellus Shale Wastewater to Surface Waters in Pennsylvania." *Environmental science & technology* 47.7 (2013): 3472–3481. *NCBI PubMed*. Web.
- Fontenot, Brian E et al. "An Evaluation of Water Quality in Private Drinking Water Wells near Natural Gas Extraction Sites in the Barnett Shale Formation." *Environmental Science & Technology* (2013): n. pag. *ACS Publications*. Web. 7 Aug. 2013.
- Gordalla, Birgit C., Ulrich Ewers, and Fritz H. Frimmel. "Hydraulic Fracturing: A Toxicological Threat for Groundwater and Drinking-Water?" *Environmental Earth Sciences* 70.8 (2013): 3875–3893. *link.springer.com.proxy.library.cornell.edu*. Web. 2 Feb. 2014.
- Gross, Sheryl A et al. "Analysis of BTEX Groundwater Concentrations from Surface Spills Associated with Hydraulic Fracturing Operations." *Journal of the Air & Waste Management Association (1995)* 63.4 (2013): 424–432. Print.
- Heilwell, Victor M. et al. "A Stream-Based Methane Monitoring Approach for Evaluating Groundwater Impacts Associated with Unconventional Gas Development." *Groundwater* 51.4 (2013): 511–524. *Wiley Online Library*. Web. 31 Jan. 2014.

Bibliography of Peer-Reviewed Articles Pertaining to Health-Related Implications of Shale Gas Development

[Pick the date]

- Jackson, R E et al. "Groundwater Protection and Unconventional Gas Extraction: The Critical Need for Field-Based Hydrogeological Research." *Ground water* 51.4 (2013): 488–510. *NCBI PubMed*. Web.
- Jackson, Robert B. "Managing Wastewater from Fracking, with Robert B. Jackson by Ahearn Ashley." *Environmental health perspectives* 120.2 (2012): 1 p preceding a58. Print.
- Jackson, Robert B. et al. "Increased Stray Gas Abundance in a Subset of Drinking Water Wells near Marcellus Shale Gas Extraction." *Proceedings of the National Academy of Sciences* (2013): n. pag. *www.pnas.org*. Web. 25 June 2013.
- Kassotis, C. D. et al. "Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region." *Endocrinology* (2013): n. pag. *CrossRef*. Web. 17 Jan. 2014.
- Molofsky, Lisa J et al. "Evaluation of Methane Sources in Groundwater in Northeastern Pennsylvania." *Ground water* 51.3 (2013): 333–349. *NCBI PubMed*. Web.
- . "Evaluation of Methane Sources in Groundwater in Northeastern Pennsylvania." *Ground water* 51.3 (2013): 333–349. *NCBI PubMed*. Web.
- Myers, Tom. "Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers." *Ground Water* 50.6 (2012): 872–882. *Wiley Online Library*. Web. 5 June 2013.
- Olmstead, Sheila M et al. "Shale Gas Development Impacts on Surface Water Quality in Pennsylvania." *Proceedings of the National Academy of Sciences of the United States of America* 110.13 (2013): 4962–4967. *NCBI PubMed*. Web.
- Osborn, Stephen G. et al. "Methane Contamination of Drinking Water Accompanying Gas-Well Drilling and Hydraulic Fracturing." *Proceedings of the National Academy of Sciences* (2011): n. pag. *www.pnas.org*. Web. 4 June 2013.
- Papoulias, Diana M., and Anthony L. Velasco. "Histopathological Analysis of Fish from Acorn Fork Creek, Kentucky, Exposed to Hydraulic Fracturing Fluid Releases." *Southeastern Naturalist* 12.sp4 (2013): 92–111. *BioOne*. Web. 23 Jan. 2014.
- Penningroth, Stephen M. et al. "Community-Based Risk Assessment of Water Contamination from High-Volume Horizontal Hydraulic Fracturing." *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy* 23.1 (2013): 137–166. *CrossRef*. Web. 12 June 2013.
- Rahm, Brian G., and Susan J. Riha. "Toward Strategic Management of Shale Gas Development: Regional, Collective Impacts on Water Resources." *Environmental Science & Policy* 17 (2012): 12–23. *ScienceDirect*. Web. 23 Jan. 2014.
- Rozell, Daniel J, and Sheldon J Reaven. "Water Pollution Risk Associated with Natural Gas Extraction from the Marcellus Shale." *Risk analysis: an official publication of the Society for Risk Analysis* 32.8 (2012): 1382–1393. *NCBI PubMed*. Web.
- Rozell, Daniel J., and Sheldon J. Reaven. "Water Pollution Risk Associated with Natural Gas Extraction from the Marcellus Shale." *Risk Analysis* 32.8 (2012): 1382–1393. *Wiley Online Library*. Web. 31 Jan. 2014.
- Saba, Tarek, and Mark Orzechowski. "Lack of Data to Support a Relationship between Methane Contamination of Drinking Water Wells and Hydraulic Fracturing." *Proceedings of the National Academy of Sciences* 108.37 (2011): E663–E663. *www.pnas.org*. Web. 18 June 2013.
- Saiers, James E., and Erica Barth. "Potential Contaminant Pathways from Hydraulically Fractured Shale Aquifers." *Ground Water* 50.6 (2012): 826–828. *Wiley Online Library*. Web. 25 Oct. 2013.
- Schmidt, Charles W. "Estimating Wastewater Impacts from Fracking." *Environmental Health Perspectives* 121.4 (2013): a117. *PubMed Central*. Web. 23 Jan. 2014.
- Schon, Samuel C. "Hydraulic Fracturing Not Responsible for Methan Migration." *Proceedings of the National Academy of Sciences* 108.37 (2011): E664–E664. *www.pnas.org*. Web. 18 June 2013.
- Sharma, Shikha et al. "Isotope Approach to Assess Hydrologic Connections During Marcellus Shale Drilling." *Ground water* (2013): n. pag. *NCBI PubMed*. Web.

**Bibliography of Peer-Reviewed Articles Pertaining to Health-Related
Implications of Shale Gas Development
[Pick the date]**

- Vengosh, Avner et al. "The Effects of Shale Gas Exploration and Hydraulic Fracturing on the Quality of Water Resources in the United States." *Procedia Earth and Planetary Science* 7 (2013): 863–866. *ScienceDirect*. Web. 2 Oct. 2013.
- Vidic, R. D. et al. "Impact of Shale Gas Development on Regional Water Quality." *Science* 340.6134 (2013): n. pag. *www.sciencemag.org*. Web. 12 June 2013.
- Warner, Nathaniel R., Robert B. Jackson, et al. "Geochemical Evidence for Possible Natural Migration of Marcellus Formation Brine to Shallow Aquifers in Pennsylvania." *Proceedings of the National Academy of Sciences* (2012): n. pag. *www.pnas.org*. Web. 5 June 2013.
- Warner, Nathaniel R., Sidney A. Christie, et al. "Impacts of Shale Gas Wastewater Disposal on Water Quality in Western Pennsylvania." *Environmental Science & Technology* (2013): n. pag. *ACS Publications*. Web. 2 Oct. 2013.
- Wiersberg, Thomas, and Jörg Erzinger. "Chemical and Isotope Compositions of Drilling Mud Gas from the San Andreas Fault Observatory at Depth (SAFOD) Boreholes: Implications on Gas Migration and the Permeability Structure of the San Andreas Fault." *Chemical Geology* 284.1 (2011): 148–159.
- Zeng, Guangming, Ming Chen, and Zhuotong Zeng. "Shale Gas: Surface Water Also at Risk." *Nature* 499.7457 (2013): 154. *NCBI PubMed*. Web.

BACKGROUND ON ARTICLES ASSESSING HEALTH IMPACTS OF SHALE GAS DEVELOPMENT

February 3, 2014, NYS Legislative Hearing on DOH Budget

The effects of shale gas development on human and animal health are only now undergoing rigorous scientific scrutiny. This is not surprising given the explosive growth of unconventional techniques in gas and oil exploration (e.g., high volume, horizontal hydraulic fracturing). During this growth, the burden of assessing the industry's environmental and public health impacts has been the public's to bear.

The scientific community is beginning to catch up thanks to the availability of recently published papers assessing the industry's potential acute and chronic impacts on health. Shale gas development has expanded rapidly in some areas throughout the past decade (e.g., Texas and Pennsylvania), yet, more than half of the articles on health risks and outcomes have been published in just the last year.

The peer-review process is the cornerstone of scientific inquiry. A national team of experts, Physicians Scientists & Engineers for Healthy Energy (PSE), is committed to providing citizens and policymakers with objective evidence-based information on the ramifications of energy procurement. Towards that end PSE has identified **145 peer-reviewed articles that are in effect a glaring yellow light demanding ongoing cautious analysis before New York State proceeds with shale gas development.**

It is becoming increasingly clear that shale gas development is harming our health. Vulnerable populations, such as children and infants, remain a particular concern. More epidemiological data is forthcoming as initial findings still under review already suggest adverse impacts on infant health associated with shale gas development in Pennsylvania. Data obtained from the Pennsylvania Vital Statistics Natality records and the Pennsylvania Department of Environmental Protection (PA DEP) suggest higher prevalence of low birth weight, an increase in small for gestational age, and a significant reduction in developmental indicators in infants living in close proximity to shale gas operations. Another recent study from Colorado published last week in the leading peer-reviewed journal, *Environmental Health Perspectives*, showed an association between density of drilling and proximity to natural gas wells and prevalence of congenital heart defects (CHDs) and possibly neural tube defects (NTDs) in infants.

Complicating these kinds of epidemiological assessments is the fact that some diseases have very long latency periods. Cancers, respiratory diseases, neurologic impairments and other possible effects of exposure to toxins secondary to shale gas development may take years to manifest themselves in humans.

Finally, it must be noted that shale gas operations encompass a myriad of potentially harmful procedures. It is strongly suspected that hydraulic fracturing chemicals and the

flowback and produced waters secondary to the fracturing process can be harmful in the short-term. But the effects of long-term ozone exposure and air pollution on cardiovascular and respiratory diseases and mortality will require rigorous long-term scientific study before their prevalence is fully understood. Indeed just the vast increase in corollary truck traffic required by the process could have a profound effect on human health in New York State (as it is strongly suspected to have in other states currently hosting these operations).

The NYS DOH is to be commended for continuing its conscientious scrutiny of existing and emerging scientific data elucidating the association of shale gas development and harmful impacts on the health of people and animals in the target zones and beyond.

(CONTACT: Jake Hays at Physicians Scientists & Engineers for Healthy Energy for copies of articles and for further information: hays@psehealthyenergy.org)