2021 Shale Network Workshop

Abstracts

ABSTRACTS

FOR

ORAL

PRESENTATIONS

Using Data to Promote Better Dialogue about Future and Developing Issues around Shale Gas Development

Susan Brantley, Penn State University
Jennifer Baka, Penn State University

The Shale Network Workshop has been hosted by Penn State in collaboration with other institutions since 2012. Our first workshop attracted fewer than 40 participants and we have grown to more than 100 participants annually from industry, watershed groups, academia, nonprofits, and government. We seek to present talks and field trips to learn together about shale gas development and the potential for environmental impacts. No consensus is developed at the workshop, but we try to explore issues by looking at data. One of our main efforts has been to publish a database of water quality for PA and surrounding states (but mostly PA) in areas of shale gas development. The Shale Network database now has more than 1.5 million data values and many publications have explored the data and its implications. At the end of each workshop, we discuss what topics should be included in future years. A big focus of our work is to address the question: how can we have better dialogue around environmental issues related to shale gas (and increasingly, other energy industries) in Pennsylvania and surrounding states? How can communities become more involved in decision making in these important areas? This introductory talk will set the stage and ground rules for the workshop.

Unconventional natural gas development in the Pennsylvania Marcellus Shale: The Current Public Health Perspective

Joan Casey, Columbia University Mailman School of Public Health

The number of unconventional wells drilled in the Pennsylvania Marcellus Shale continues to grow by over 500 wells per year. Epidemiologic evidence suggests that density and proximity of such wells is associated with increased risk of several adverse health outcomes. This presentation will provide an overview of studies conducted in the region, including those on adverse pregnancy outcomes, mental health problems, and asthma exacerbations. It will conclude with suggestions for future directions.

Challenges in Health-Based Research Near Oil & Gas Development

James P. Fabisiak, University of Pittsburgh Graduate School of Public Health

The number of unconventional wells drilled in the Pennsylvania Marcellus Shale continues to grow by over 500 wells per year. Epidemiologic evidence suggests that density and proximity of such wells is associated with increased risk of several adverse health outcomes. This presentation will provide an overview of studies conducted in the region, including those on adverse pregnancy outcomes, mental health problems, and asthma exacerbations. It will conclude with suggestions for future directions.

Health-Based Evaluation of Ambient Air Measurements Near a Marcellus Shale Unconventional Natural Gas Well Pad Site and a School Campus

Christopher Long, Gradient

Co-authors for study:
Nicole Briggs, Gradient
Brian Cochran, Spectrum Environmental Solutions
Destiny Mims, Gradient

Conducted in an area of Washington County, Pennsylvania, with extensive Marcellus Shale development, this study investigated whether operations at an unconventional natural gas well pad may contribute to ambient air concentrations of potential health concern at a nearby school campus. Almost two years of air monitoring for fine particulate matter (PM2.5) and volatile organic compounds (VOCs) was performed at three locations between 1,000 to 2,800 feet from the study well pad from December 2016 through October 2018. All measurement data of PM2.5 and 58 VOCs, which reflect the cumulative contributions of emissions from the study well pad and other local/regional air pollutant sources (e.g., other well pads), were below health-based air comparison values, and thus do not provide evidence of either 24-hour or long-term air quality impacts of potential health concern at the school.

Enhancing the Utility of Epidemiology in Assessing Potential Health Risks from Shale Gas Development

Uni Blake, American Petroleum Institute

Different types of disciplines (toxicology, epidemiology, and exposure) have the common goal of providing the invaluable information necessary to address the concerns regarding the potential for health effects resulting from oil and gas development activities. However, challenges surface when the findings from the studies are utilized in informing risk assessments without proper context. This presentation utilizes a matrix developed to bridge the gap between epidemiology and risk assessment. The Matrix here is used as a tool to improve understanding and communication between the disciplines, and to enhance how the epidemiology studies can be used in public health decision-making and risk communication.

Conducting Research to Inform Environmental Health Policies Around Potential Health Risk from Unconventional Oil and Gas Development

Anna Rosofsky, Health Effects Institute
Donna Vorhees, Health Effects Institute
Energy Research Committee

Rapid expansion of unconventional oil and gas development (UOGD) has prompted public concern and scientific inquiries about associated exposures and health effects. There is a need for health and exposure research designed to help decision makers identify strategies to protect public health. This talk will summarize current approaches to understanding exposures and health risks from UOGD, and will provide recommendations for future studies to be of utility to decision-makers.

Pipeline Development from the Regulatory Perspective

Andrew Foley, PA Department of Environmental Protection
Domenic Rocco, PA Department of Environmental Protection

Pennsylvania has made steady improvements to its permitting and regulatory processes towards achieving responsible development of pipeline infrastructure in the commonwealth. This includes a dozen top recommendations and a broader set of 184 suggestions from the Pipeline Infrastructure Task Force in 2016. One of those recommendations was to establish a centralized entity at Pennsylvania's Department of Environmental Protection (DEP) related to the construction of pipelines and other linear projects. This resulted in the creation of the Regional Permit Coordination Office (RPCO) which was officially established in 2018 as a centralized permitting office responsible for specialized Chapter 102 and 105 permits as well as associated approval of Section 401 State Water Quality Certifications (SWQC). RPCO also provides statewide technical support and coordination. This presentation will outline RPCO's role, as well as the different roles of each DEP office, regarding pipeline development. We will also take the opportunity to briefly cover efforts underway for policy and guidance development to help the pipeline permitting process become more efficient.

Community Perspectives and Responses to Pipeline Development and Public Health Risks

Kirk Jalbert, Arizona State University

Pipeline operators consider many factors when searching for a viable right-of-way for their projects; perhaps most significant is identifying landowners amenable to allowing pipelines on their property. This presentation discusses the results of a survey of easement-signing and neighboring landowners in Pennsylvania implicated in the Falcon Ethane Pipeline System. The study seeks to understand the role of landowners in pipeline planning, why they assume risks to personal health, property, and environment, and how their relationships to pipelines change over time.

Summarizing USGS studies of the effects of unconventional oil and gas activities on groundwater quality in 5 U.S. Shale Basins

Bruce Lindsey, USGS
Peter McMahon, USGS

The USGS National Water-Quality Assessment project sampled wells in 5 major shale basins in the United States to evaluate potential effects of unconventional oil and gas exploration on groundwater quality. The studies were conducted from 2014 and 2018 in the Eagle Ford, Haynesville, Fayetteville, Marcellus, and Williston Formations. No widespread hydrocarbon-related contamination was found in these studies, and most of the detected methane was determined to be biogenic.

Managing Produced Water in a New Decade

Loren Anderson, Marcellus Shale Coalition
Jon Dufalla, Range Resources

Managing produced water from Marcellus Shale development in a down cycle of commodity prices creates opportunities and challenges alike. Operators need to remain up to speed on reuse opportunities available to them, as well as disposal and treatment options while remaining focused on budgetary concerns of their own organizations. Short- and long-term strategic planning for produced water management is essential in navigating the commodity cycle and Regulatory environment to ensure that Operators can manage their produced water in an environmentally compliant and economic manner.

An EPA Regulatory Update: Oil and Gas Clean Air Act Section 111 & Produced Water Policies

Taimur A. Shaikh, US Environmental Protection Agency

Executive order 13990 “Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis” instructs EPA to, by rulemaking, reduce methane emissions in the Oil and Gas (O&G) sector by suspending, revising, or rescinding previously issued new source performance standards (NSPS) as well as establish emission guidelines for methane and VOC emissions from existing sources in the O&G sector. Current regulatory pathways to achieve the goals stated in the executive order are discussed. Additionally, produced water discharges under the National Pollution Discharge Elimination System permitting framework are discussed with particular focus on current reuse activities both within and outside of the oil patch.

Overview of Air Quality Monitoring Program for Shell's Petrochemical Facility in Monaca, PA

H. James Sewell, Shell Chemical Company
Kimberly Kaal, Shell Chemical Company

We will provide an environmental and project overview of the Shell's Petrochemical Facility project in Monaca, PA. We will discuss the development of the air program and monitoring as we approach start-up of the project.

Community Challenges and Choices Amidst Petrochemical Development

Matthew M. Mehalik, Breathe Project

The intensity of unconventional resource extraction in Southwestern Pennsylvania over the past decade has driven to the fore many difficult choices for local community members, with limited scientific and health-related knowledge and information about consequences available in many cases. Now that the presence of petrochemical development is maturing, communities are learning more and are discovering new choices based on evolving science and health information for setting a community's future direction. This presentation will offer an overview of some of these issues as well as some of the latest initiatives, tools, and campaigns that the Collaborative has developed to help support front line community members facing these challenges.

Remediation of Orphaned Wells – Challenges and Opportunities

Gani Sagingaliyev, Affirmed Resources

With a quarter million documented orphan and idle wells across the nation, and up to three quarters of a million undocumented, the issue of remediation and prevention continues to pose a serious challenge. Documented numbers stay stubbornly high despite ongoing efforts in plugging over the past 30 years. Statistically reliable measurements are scarce, and data siloes exist, preventing a wholistic nationwide view, and uneven funding mechanisms lower localized program efficiencies. Multiple efforts under development may facilitate sustainable steps toward resolution: data collection, federal legislation, and innovative solutions through private-public partnerships.

Environmental Hazards and Local Investment: A Half-Century of Evidence from Abandoned Oil and Gas Wells

Max Harleman, University of Pittsburgh
Jeremy G. Weber, University of Pittsburgh
Daniel Berkowitz, University of Pittsburgh

Conservative estimates suggest that the United States has more than one million abandoned oil and gas wells that were never properly decommissioned (plugged) and may therefore leak harmful liquids and gases. Exploiting the quasi-random assignment of well plugging in a large county in Pennsylvania, we find that over half a century the two acres around unplugged wells had roughly half as much building as around plugged wells. Foregone investment, in turn, depressed property values by 12 percent. The effect appears to stem from disincentives to invest and not from poorer households sorting to properties near unplugged wells.

Federal Orphan Well Plugging Stimulus Legislation: Opportunities for Pennsylvania

Adam Peltz, Environmental Defense Fund

160+ years of oil and gas development has left Pennsylvania with hundreds of thousands of "orphan" oil and gas wells that can contaminate groundwater and cause methane leakage. Since the start of the pandemic, policymakers have been considering stimulus opportunities with environmental benefits, and orphan well plugging and remediation in particular has garnered support from legislators from both parties and in both chambers of Congress, along with the White House. As the state with the most orphan wells in the country, Pennsylvania stands to be a major beneficiary of proposed legislation -- this talk will outline legislative efforts to date and explore implications for Pennsylvania, including potential avenues for policy reform to reduce future orphan well burden.

PRE-RECORDED ABSTRACT PRESENTATIONS

Public Data from Three US States Provide New Insights into Well Integrity

Authors: *Greg Lackey[1,2], Harihar Rajaram[3], James Bolander[4], Owen A. Sherwood[5], Joseph N. Ryan[6], Chung Yan Shih[1,2], Grant Bromhal[1], and Robert M. Dilmore[1]*

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Oil and gas wells with compromised integrity are a concern because they can potentially leak hydrocarbons or other fluids into groundwater and/or the atmosphere. Most states in the US require some form of integrity testing, but few jurisdictions mandate widespread testing and open reporting on a scale informative for leakage risk assessment. In this study, we searched 33 US state oil and gas regulatory agency databases and identified records useful for evaluating well integrity in Colorado, New Mexico, and Pennsylvania. In total, we compiled 474,621 testing records from 105,031 wells across these states into what is now the largest publicly available US well integrity dataset. We found that 14.1% of wells tested prior to 2018 in Pennsylvania exhibited sustained casing pressure (SCP) or casing-vent flow (CVF) – two indicators of compromised well integrity. Data from different hydrocarbon-producing regions within Colorado and New Mexico revealed a wider range (0.3%-26.5%) of SCP and/or CVF occurrence than previously reported, highlighting the need to better understand regional trends in well integrity. Directional wells were more likely to exhibit SCP and/or CVF than vertical wells in Colorado and Pennsylvania, and their installation corresponded with statewide increases in SCP and/or CVF occurrence in Colorado (2005-2009) and Pennsylvania (2007-2011). Testing the ground around wells for indicators of gas leakage is not a widespread practice in the states considered. However, 3.0% of Colorado wells tested and 0.1% of New Mexico wells tested exhibited a degree of SCP sufficient to potentially induce leakage outside the well.

Stream Sulfate Concentrations Decrease as U.S. Power Plants Shift from Coal to Shale Gas

Authors: *Tao Wen[1], Xianzeng Niu[2], Susan. L. Brantley[2,3]*

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An increasing number of U.S. power plants have switched from burning coal to burning natural gas since the early 2000s, leading to less SO_2 emissions into the atmosphere. We investigated whether stream chemistry (i.e., SO_4^{2-}) also benefits from this transition. Using publicly available data from Pennsylvania, a U.S. state with heavy usage of coal as fuel, we found that the impact of SO_2 emissions on stream SO_4^{2-} can be observed as far as 63 km from power plants. We developed an empirical model that incorporates an emission-control technology trend for coal-fired power plants to quantify potentially avoided SO_2 emissions and stream SO_4^{2-} as power plants switched from coal to gas. The results show that, if 30% of the electricity generated by coal in Pennsylvania in 2017 had been replaced by that from natural gas, a total of 20.3 thousand tons of SO_2 emissions could have been avoided and stream SO_4^{2-} concentrations could have decreased as much as 10.4%. Extrapolating the model to other states in the U.S., we found that as much as 46.1 thousand tons of SO_2 emissions per state could have been avoided for a similar 30% coal-to-gas switch, with potential amelioration of water quality near power plants. The emission-control technology trend model provides a valuable tool for policy makers to assess the benefits of coal-to-gas shifts on water quality improvements as well as the effectiveness of emission control technologies.

Community-owned Monitoring Networks Support Comprehensive Understanding of Air Pollution Impact and Establish Baselines

Authors: *Leatra Harper, Fresh Water Accountability Project, Ana Hoffman, CREATE Lab*

Belmont County, Ohio remains minimally monitored by conventional infrastructure, with a single US Environmental Protection Agency monitoring location in Shadyside, Ohio providing baseline monitoring. This does not provide the spatial or temporal coverage needed to monitor sudden local spikes in emissions that can impact the health of local communities.

Freshwater Mussels Monitor Water Quality Downstream of Oil and Gas Disposal

Author: *Nathaniel Warner- Civil and Environmental Engineering Penn State*

Release of oil and gas wastewater to rivers in Pennsylvania through permitted discharges has left a legacy of increased radium activity in stream sediment. The potential implications of higher radium activity on aquatic life has yet to be investigated. Here we present results of two investigations to determine the impact of oil and gas wastewater disposal on freshwater mussels. First, in a controlled laboratory experiment we demonstrate accumulation of radium in soft tissue correlates with the dose to produced water. The second study is a survey of freshwater mussels near historical discharges of oil and gas wastewater to the Allegheny River. In the Allegheny, we demonstrate increases in radium activity of soft tissue of freshwater mussels that live downstream of oil and gas wastewater discharges.

Investigating the Sources and Extent of Groundwater Contamination in Areas of Extensive Oil, Gas, and Coal Extraction Using Data Mining

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The water resource impacts of unconventional oil and gas development (UOGD) can be difficult to delineate from longstanding geogenic and anthropogenic impacts on groundwater chemistry, particularly where UOGD may overlap with decades to centuries of legacy hydrocarbon extraction (conventional oil and gas, coal mining). In this study, southwestern Pennsylvania, U.S.A. was selected as a testbed to investigate how the overlap of intensive recent UOGD and widespread, longstanding hydrocarbon extraction in the region may impact water chemistry and the ability of data mining methods to delineate the impacts of the wide array of geogenic and anthropogenic contaminant sources present. Using a geospatial statistics-based data mining tool, locations where the concentrations of a species (e.g. methane) significantly increase nearby features of interest (e.g. unconventional oil and gas wells) were mapped across the study area. Additionally, unsupervised machine learning (non-negative matrix factorization, NMF) was applied to delineate endmember sources of groundwater species and their contributions to groundwater chemistry in the region. A small number of subregions where UOGD may have contaminated groundwater with methane or brine components were identified. However, the overlap of UOGD with legacy hydrocarbon extraction does not appear to make UOGD more prone to contamination, and methane migration incidents appear less frequent than in other areas of the state with extensive UOGD. However, significant increases in sulfate concentrations are widely observed nearby coal mining areas, and coal mining has elevated concentrations of sulfate above “baseline” on a regional scale. Additionally, chloride concentrations are significantly elevated nearby highways across the study area, and road salting is a regionally significant source of chloride in groundwater. Thus, while UOGD may not be more prone to contamination incidents, regions of extensive hydrocarbon extraction are characterized by widespread, often overlapping sources of groundwater contamination that can be distinguished using data-driven methods.