All Hands Session Abstracts

All Hands Session 1—Hydraulic Fracturing: Benefits and Environmental Impacts

AH1

A Cradle-to-Grave Explanation of the Construction, Completion, and Operation of a Hydraulically-Stimulated Natural Gas Well. Melton Jr. DC. Southwestern Energy Inc., Conway, AR, United States.

Southwestern Energy, Inc., through its subsidiary SEECO, Inc., has drilled and completed approximately 3,500 natural gas wells in the Fayetteville Shale in the north-central Arkansas portion of the Arkoma Basin and plans to drill approximately 380 to 390 wells in 2013. The Fayetteville Shale is the geologic equivalent to the Barnett Shale of Texas and is a laterally extensive organic rich shale which produces dry natural gas from depths of 1,500 to 6,500 feet below the surface. The Mississippian-aged (~354-323 million years) formation varies in thickness from 50 to 550 feet and requires hydraulic stimulation to produce commercial quantities of natural gas. The life cycle of a gas well begins with the construction of a pad, progresses through the drilling of a vertical pilot hole, the development of a horizontal lateral, and the subsequent hydraulic stimulation prior to production. The slick water hydraulic stimulation used in the Fayetteville Shale by SEECO would utilize approximately 4,200,000 gallons of water and 4,000,000 pounds of silica sand in an average stimulation effort. The typical composition of a fracturing fluid in the Fayetteville Shale would be water and sand (99.9%), glutaraldehyde (0.05%), polyacrylamide (0.05%), ethylene glycol (0.01%), citric acid (0.00489%), and N,n-dimethyl formamide (0.00088%). SEECO, Inc. is currently recycling 100% of the flowback water from stimulation procedures.

AH2

Chemical Additives to Hydraulic Fracking Fluids: Assessing Genotoxic Risks. Lloyd RS. Center for Research on Occupational and Environmental Toxicology, Oregon Health and Science University, Portland, OR, United States.

For nearly sixty years, the oil and gas industry has used complex mixtures of water, sand, and chemical additives that are injected deep underground at high pressures to improve the overall rate and efficiency of recovery of oil and gas. This process is termed hydraulic fracturing or “fracking” and results in the introduction and maintenance of fissures into oil-bearing sediments. The chemical additives are designed to maintain fluid viscosity, minimize friction between the fluids and the pipe, prevent pipe corrosion, dissolve minerals, and control bacterial growth. In recent years, the development of horizontal drilling techniques, combined with fracking methodologies, have dramatically increased the potential to extract vast quantities of petroleum reserves in the United States and worldwide. Typically, the fracking solution contains 0.5-2.0% of the total volume as the total chemical additive, with the remaining solution consisting of eight percent sand and water; exact formulations vary significantly with the specific geology that is encountered. Although federal regulations do not require full disclosure of the exact composition of the chemical additives (based on proprietary formulations), data mining of MSDS records reveal the identity of many of these compounds, some of which could have human health implications. However, the problem of assessing human health concerns is not as simple as the identity of the chemicals being injected but of the extraordinarily complex mixtures that are recovered from these wells during production. The potential genotoxicities of a subset of these agents, as well as relevant DNA damage responses, will be discussed.

AH3

Occupational Exposures to Silica Associated with Hydraulic Fracturing: National Institute for Occupational Safety and Health (NIOSH) Field Operations. Weston A. National Institute for Occupational Safety and Health, CDC, Morgantown, WV, United States.

Throughout the Institute’s history, NIOSH has engaged in occupational safety and health research in extraction industries (e.g., mining), but only since 2005 has NIOSH focused on upstream oil and gas extraction. During initial site visits at oil and gas wells, it was observed that notable amounts of silica-containing proppant, or frac-sand, are used during hydraulic fracturing operations. This observation led to research of workers’ exposures to silica at 11 sites in 5 states. In 2010-2011, full shift (typically 12 hours) personal breathing zone samples for respirable silica were collected from workers in 15 job categories who participated voluntarily. Sample analyses were performed by an accredited laboratory, using validated NIOSH methods. Time-weighted average concentrations of respirable crystalline silica were calculated for comparisons with the Occupational Safety and Health Administration permissible exposure limit (PEL), the NIOSH recommended exposure limit (REL), and the American Conference of Governmental Industrial Hygienists threshold limit value (TLV®). Of a total of 111 individual samples collected, 93 (83.8%) exceeded the TLV, 76 (68.5%) exceeded the REL, and 57 (51.4%) exceeded a calculated PEL, in some cases by more than 10-fold the PEL, REL, or TLV. By job category, sand mover and transport belt operators had the highest exposures. Risks for silica exposures are significant during hydraulic fracturing due to the quantity of sand used and the way it is handled. Seven primary points of dust generation were identified in this study along with recommendations for controls.

AH4

Abstract not available.

All Hands Session 2—The Exposome

AH5

Abstract not available.

AH6

Epidemiological Approaches to the Exposome. Vineis P, Kelly F, Phillips DH, Elliott P. MRC-PHE Centre for Environment and Health, Imperial College London and King’s College London, London, United Kingdom.

The exposome concept refers to the totality of exposures from a variety of sources including, chemical and biological agents, from conception onwards (over the lifecourse) and offers a conceptual leap in studying the role of the environment in human disease. Our Centre is leading several initiatives in the field of the exposome in collaboration with numerous partners in Europe and the US. The programme is based on the application of omic technologies (epigenomics, adductomics, proteomics, transcriptomics, and metabolomics including gut microbiome cometabolites) within large European population cohorts. Our strategy has several goals: a) to generate new hypotheses on the aetiology of noncommunicable diseases; b) to lend biological credibility to associations found in observational studies and strengthen causality; (c) to identify mechanisms of action of environmental exposures; d) to contribute to the estimation of the burden of disease associated with environmental factors. The EU-funded project Exposomics is measuring untargeted omics, including the newly developed adductomics, in people with environmental measures (air pollutants and water contaminants). The Epi-Migrant study involves epigenetic analyses of South Asian populations in different settings around the world; including the west London based Lolipop study. Combi-Bio is applying top-down systems biology approaches based on metabolic phenotyping and computational medicine to discover, test, and validate novel biomarkers for subclinical atherosclerosis and to develop prognostic combinational biomarkers and risk scores to improve early prediction and patient stratification for subclinical atheroscleriosis. Overall these programmes encompass >10,000 individuals with chronic diseases (cancer, metabolic disease, and cardiovascular disease) and cover a range of hypotheses and exposures.

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