

Hydraulic Fracturing

in Colorado: A Public Forum

August 8, 2009
9:00 a.m. to 5:00 p.m.
Glenwood Springs, Colorado

Program

Saturday, August 8, 2009

8:00 a.m. — 9:00 a.m. • Registration

Welcome and Opening Remarks

9:00 a.m. — 9:10 a.m.

Larry Cerrillo, CPG, Moderator - Ingenuity Enterprises International, Inc.
Graham Closs, CPG, Moderator - Professor, Colorado School of Mines

Groundwater Basics

9:10 a.m. — 9:50 a.m.

Robert J. Sterrett, PhD - HCltasca, Denver, Inc.

Basics of Hydraulic Fracturing

9:50 a.m. — 10:10 a.m.

Mike Eberhard, PE - Halliburton Energy Services

10:10 a.m. — 10:30 a.m.

Questions and Answers

10:30 a.m. — 10:45 a.m. • Break

Toxicology

10:45 a.m. — 11:15 a.m.

Scott D. Phillips, MD - Rocky Mountain Poison and Drug Center

Potential Health Effects

11:15 a.m. — 11:45 a.m.

Roxana Zulauf Witter, MD, MSPH, MS - Colorado School of Public Health, University of Colorado Denver

11:45 a.m. — 12:15 p.m.

Teresa Coons, PhD - Western Colorado Math and Science Center

12:15 p.m. — 1:15 p.m. • Lunch (provided)

Sponsored By The American Institute of Professional Geologists and Mountain & Plains ERC



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Public Relations Aspects

1:15 p.m. — 1:35 p.m.

Doug Hock - EnCana Oil and Gas (USA) Inc.

County, State and Federal Perspectives

1:35 p.m. — 1:55 p.m.

Judith Jordan - Garfield County

1:55 p.m. — 2:15 p.m.

Bruce Bertram, LGD - Delta County

2:15 p.m. — 2:35 p.m.

Mesa County (Will Provide a Statement)

2:35 p.m. — 2:55 p.m.

David Andrews - COGCC

2:55 p.m. — 3:15 p.m.

William Howell, PE - BLM, Glenwood Springs Energy Office

3:15 p.m. — 3:35 p.m.

Nathan Wiser - EPA

3:35 p.m. — 4:00 p.m. • Break

Panel Discussion and Questions/Answers

4:00 p.m. — 5:00 p.m.

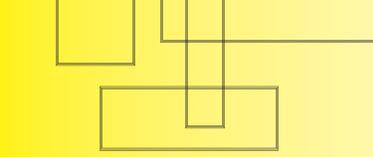
All Presenters. Moderated by Larry Cerrillo and Graham Closs

Closing Remarks

5:00 p.m. — 5:10 p.m.

Sponsored By The American Institute of Professional Geologists and Mountain & Plains ERC





Presenter Biographies

Robert J. Sterrett, PhD - HCltasca, Denver, Inc.

Principal Hydrogeologist with HCltasca Denver, Inc. Dr. Sterrett has over 25 years of experience in the areas of groundwater and contaminant transport analysis, and soil and groundwater remediation. His expertise includes analysis of the fate and transport of chemicals in the vadose zone; and the design and analysis of soil and groundwater remediation systems. He has also undertaken the analysis of mine and construction dewatering systems. Dr. Sterrett was the technical editor and chief contributor to the 3rd edition of Groundwater and Wells.

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Mike Eberhard, Professional Engineer (PE) - Halliburton Energy Services

Mike Eberhard is the Rocky Mountain Technical Manager for Halliburton Energy Services located in Denver. He has been with Halliburton nearly 28 years and has worked in various pumping services positions; field engineering, sales, technical team, and management positions. Eberhard holds a BS in mechanical engineering from Montana State University. Mr. Eberhard has authored and co-authored several papers and publications. He is a 2009-10 Society of Petroleum Engineers (SPE) Distinguished Lecturer and is a member of SPE, AADE, DWLA, and is on the IAB for Montana Tech. He is also a registered professional engineer in Colorado.

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Scott D. Phillips, MD (Medical Doctor) - Rocky Mountain Poison and Drug Center

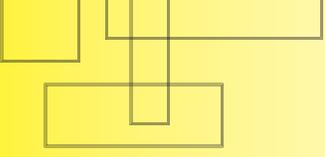
Scott D. Phillips MD, is a sub-specialty board certified medical toxicologist and also board certified in internal medicine. He is an active member of the medical school teaching faculty and is an attending physician on the clinical pharmacology/toxicology consultation service at the University Hospital and Denver Health Medical Center. Currently he holds the rank of Clinical Associate Professor of Medicine at the University of Colorado Denver. Dr. Phillips is a Fellow of the American College of Physicians, the American Academy of Clinical Toxicology and the American College of Medical Toxicology. Dr. Phillips has edited several textbooks in toxicology and authored many publications, virtually all related to clinical toxicology. He is an editor of Critical Care Toxicology: The Diagnosis and Management of the Critically Poisoned Patient and Occupational, Industrial and Environmental Toxicology. Dr. Phillips is on the teaching staff of the Rocky Mountain Poison and Drug Center, and is the Director of the Toxicology Clinic.

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Roxana Zulauf Witter, MD, MSPH, MS (Medical Doctor) - Colorado School of Public Health, University of Colorado Denver

Roxana Z. Witter is a Clinical Instructor of Environmental and Occupational Health, in the Colorado School of Public Health. She has served on the University of Colorado faculty since 2006, initially as a volunteer Clinical Instructor in the Department of Preventive Medicine in the School of Medicine from 2006-2007. In 2008, Dr. Witter was a principal investigator on a project that resulted in a literature review and white paper regarding the potential health impact of oil and gas exploration on this subject. The project involved collection and review of publicly accessible exposure and health impact data for Garfield County, Colorado. She presently teaches in the School of Public Health, co-directing and lecturing in the graduate-level course EHOH6616 "Environmental and Occupational Toxicology".

Dr. Witter completed her BS (Bachelor of Science) degree at Georgetown University and MS (Master of Science) Degree in Microbiology and Immunology at University of Colorado Medical School, where she studied



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and published on the subject of the role of calcium in programmed cell death. She earned her MD (Medical Degree) from University of Colorado School of Medicine and completed her internship at St. Joseph Hospital in Denver, Colorado in Internal Medicine. She completed her residency in Occupational and Environmental Medicine and her MSPH (Master of Science of Public Health) degree at University of Colorado Health Sciences Center/ National Jewish Research Center in Denver, Colorado, where she studied and published on the subject of health effects of methamphetamine lab exposure in law enforcement officers. She has also worked in the community as a clinician in occupational medicine and as Medical Director for a Denver based international corporation.

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Teresa Coons, PhD - Western Colorado Math and Science Center

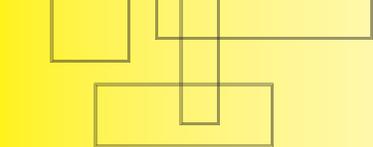
Teresa Coons received her undergraduate degree from Colorado State University in physical sciences and a Ph.D. in immunology from the University of New Mexico. She has recently assumed the position of Executive Director for the Western Colorado Math and Science Center, located in Grand Junction, CO. Her research career has spanned the disciplines of basic and clinical research, most recently focusing on occupational and environmental epidemiology. These latter studies have included descriptive studies of childhood asthma in Mesa County, Colorado and studies of respiratory conditions related to mining industry operations. Over the years, Dr. Coons' research has involved collaboration with federal, state and local governments, industry group, citizen advisory committees and grassroots activist groups. Through community-based, participatory research she has worked with culturally diverse communities to investigate health issues related to environmental impacts. This work has involved the use of focus groups, community health surveys and community action planning to identify and address community concerns. Until January of 2009, Dr. Coons was the Senior Scientist for the Saccomanno Research Institute in Grand Junction, Colorado, where she directed the research programs associated with St. Mary's Hospital and Medical Center, including participation in multi-institutional collaborations investigating genetic markers of susceptibility to lung cancer, the effects of tobacco smoke components on immune function, and early detection of lung cancer. Dr. Coons was also the organizer and, for six years, the Director of a federally funded medical screening program for former uranium workers under the Radiation Exposure Screening and Education Program. She was also the principal investigator for a study of potential health-related impacts of the natural gas industry in Garfield County, CO.

Dr. Coons is active in the Grand Junction community as a member of the Grand Junction City Council (currently Mayor Pro Tem), the Mesa County Board of Health, the Grand Junction Housing Authority Board, the Mesa County Methamphetamine Task Force, and other local organizations. She holds Adjunct faculty positions at Mesa State College and the University of Colorado Denver Health Sciences Center, and is a member of the University of Colorado Cancer Center and the Dean's Council for the College of Natural Sciences at Colorado State University. She was appointed by Governor Ritter to the Colorado Air Quality Control Commission in 2007.

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Doug Hock - EnCana Oil and Gas (USA) Inc.

Doug Hock is director of public and community relations for EnCana Oil & Gas (USA) Inc. He has worked in public relations for over 20 years, the majority of it with oil/gas and mining companies. He is a past president of the Colorado Chapter of the Public Relations Society of America (PRSA). Doug serves as chairman of the board of Parent Pathways, a Denver-based non-profit that helps teen parents raise healthy families. In addition, he chairs the Resource Allocation Committee for Denver's Road Home, the city's ten-year plan to end



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homelessness. Doug holds a bachelor's degree in news/editorial journalism from Drake University.
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Judith Jordan, Garfield County

Judy Jordan is the oil and gas liaison for Garfield County, serving as an ombudsman and coordinator between county and other governments, citizens and industry. She attended law school while managing Delaware's groundwater quality program and while working for DuPont as a hydrogeologist in the 1980s. She later worked as an attorney for the Pennsylvania DEP in their Superfund and Hazardous Sites Bureau, for Brandywine Conservancy, and was executive director of the Pennsylvania Organization for Watersheds & Rivers. She has researched and spoken extensively on water law and watershed management.

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Bruce Bertram, LGD - Delta County

Bruce Bertram is a Colorado native from Cedaredge, Colorado. He graduated from the Colorado School of Mines with a Professional Engineering degree in Geology and worked in the petroleum industry. Later, after managing and providing accounting services for a contract blasting company he returned to Delta County where he has been the County Solid Waste Coordinator. Delta County appointed Bruce as its local governmental designee to the Colorado Oil and Gas Commission seven years ago when new oil and gas activity started in the County. While continuing to provide related education for the public and industry; he remains active in County, State, and Federal oil and gas regulatory and enforcement processes.

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David Andrews, PE, PG - Colorado Oil and Gas Conservation Commission (COGCC)

David Andrews works out of COGCC's Rifle office as the Northwest Area Engineering Supervisor. COGCC's engineering group primarily regulates downhole operations in oil and gas wells. Mr. Andrews has been with COGCC for 3 ½ years, performing work in the D-J Basin and the Piceance Basin. Prior to joining COGCC, Mr. Andrews spent nearly 12 years in environmental consulting, performing work mostly for the oil and gas industry. Mr. Andrews earned a BS in Geological Engineering from Michigan Technological University and a MS in Civil Engineering from Wayne State University. He is a licensed Professional Engineer in Colorado, Michigan, and Wyoming, and he is a licensed Professional Geologist in Wyoming.

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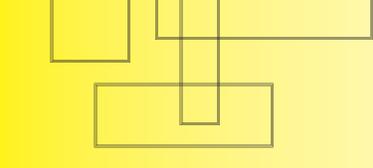
William Howell, PE - Bureau of Land Management (BLM), Glenwood Springs Energy Office

William Howell is a Petroleum Engineer currently working for the Bureau of Land Management in the Glenwood Springs energy office. Mr. Howell has a BS in Petroleum Engineering from Mississippi State University and completed his graduate course work in geohydrology at the University of New Orleans.

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Nathan Wiser - Environmental Protection Agency (EPA)

Nathan Wiser is a 19-year veteran of the EPA's Underground Injection Control (UIC) program, regulating injection wells as a permit writer, inspector, and compliance officer. His educational background includes a bachelor's degree in geology from the University of California, Berkeley and a master's degree in geology from Northwestern University. Mr. Wiser works in the Region 8 (Denver) office of EPA where he is considered a regional expert in the UIC program, and serves as the program lead for UIC deep well enforcement. Mr. Wiser's



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accomplishments include the issuance of many hundreds of UIC permits and enforcement orders, conducting and overseeing thousands of injection well inspections, and he oversees a complex aquifer remediation in the East Poplar Oil Field in northeast Montana.

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Larry A. Cerrillo - Ingenuity Enterprises International, Inc.

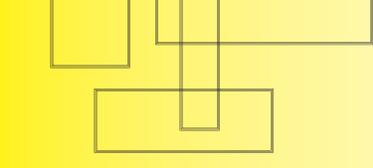
Larry Cerrillo is a past national and Colorado state section president of AIPG. He has a BS in Geology from Syracuse University and an MS in Hydrogeology from Colorado State University. Larry has worked nationally and internationally on groundwater and environmental projects. In addition to his hydrogeologic background, he has several certificates of training in alternative dispute resolution (ADR) including a certificate of advanced study in ADR from Denver University. He is currently working at his second career as a mediator, facilitator and arbitrator of environmental, public policy, water, and construction disputes.

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L. Graham Closs - Professor, Colorado School of Mines

Graham Closs received his A.B. in Geology from Colgate University (1967), his M.S. in Geology from the University of Vermont (1970), and his PhD. in Geological Sciences (1973), specializing in Exploration Geochemistry, from Queen's University (Canada). He has over 35 years experience in field programs, teaching and applied research. He is a Licensed Professional Engineer (Ontario, Canada) and a Certified Professional Geologist (American Institute of Professional Geologists). Since 1978 he has been on the faculty of the Department of Geology and Geological Engineering, Colorado School of Mines where he is involved in teaching and supervising research in the areas of economic geology, mineral exploration design, metals exploration geochemistry, and geological data analysis.

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Abstracts

Introduction to Hydrogeology

Robert J. Sterrett, Ph.D.
HCltasca, Denver, Inc.

Groundwater is an important source of water for rural residences and for agriculture. In order to protect this resource there must be a basic understanding of how groundwater flows and how chemicals are transported by it. This talk will provide a basic overview of the occurrence and movement of groundwater. Basic concepts and terms will be explained and examples provided.

Hydraulic Fracturing – What is it?

Mike Eberhard, PE
Halliburton Energy Services

Hydraulic fracturing is used extensively throughout the US to enhance well production in unconventional gas reservoirs; tight gas sandstones, shale gas, and coalbed methane (CBM). Over the last 60 years there have been over 1 million hydraulic fracture treatments completed in North America. There is growing concern that hydraulic fracturing has a potential to contaminate underground sources of drinking water. This presentation will discuss the steps taken to avoid this potential and what hydraulic fracturing is. There will be a brief discussion of what hydraulic fracturing is and the steps taken to avoid the potential problem of contamination.

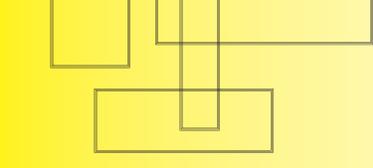
Potential Health Effects Secondary to Fracing Fluids

Roxana Witter, MD, MS, MSPH,
Colorado School of Public Health, University of Colorado Denver

Liquids and chemicals used for fracturing processes can include potentially toxic substances such as petroleum distillates, diesel fuel, acids, MTBE and BTEX, fatty acid esters and crystalline silica, among other chemicals. Most companies do not disclose the full chemical makeup of specific compounds injected into the ground.

Human exposure to fracturing chemicals can occur by many pathways, including contamination of aquifer and surface drinking water sources, volatile chemical and dust inhalation in contaminated air, and ingestion of foods grown in contaminated soil. Little is known about the levels of these chemicals in water, air, and soil in areas close to the well sites or in local communities. There is also little publicly-available data regarding the levels of contaminants and pollutants that may be affecting water and air on a regional basis.

Human health effects cause by contaminants can vary by chemical, exposure route, dose and duration. Exposures can result in acute or chronic, cancerous or non-cancerous health effects. Heath outcomes can also vary according to the population being exposed, with children, seniors, women of childbearing age, and those with pre-existing diseases generally being more susceptible than the general population to the potential toxic effects of chemical exposure. Furthermore, chemical mixtures may cause health effects that differ from those caused by individual chemicals alone.



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Predicting the potential health effects of fracking fluid exposure can be complex because of the uncertainty related to chemical identity and quantity, exposure pathway and environmental levels, and human susceptibility. Despite these unknowns, some statements can be made about the potential health effects of chemicals known to be used in the fracking process. A number of fracking chemicals are known carcinogens and mutagens, some with no known safe level of exposure. Many chemicals are known to cause significant long term health effects, such as neurological, reproductive and renal effects while others are known to cause significant acute illness such as respiratory and cardiac effects and irritant symptoms.

Because information regarding the chemicals themselves and the levels of chemicals in the water, air and soil is incomplete, the potential for the fracking process to impact the health of local and regional human populations remains a possibility, yet the extent of potential impact remains unknown. In the interest of protecting workers and community members, steps should be taken to prevent exposures from occurring while research is conducted to establish exposure levels and possible health consequences.

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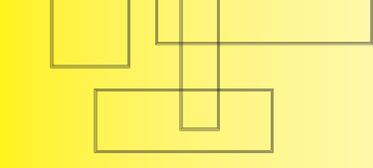
Judith Jordan
Garfield County

The issue of hydraulic fracturing, or “fracing,” has received a lot of attention from environmental groups and recently has drawn congressional scrutiny, largely because in 2005 the Congress, then with a Republican majority, had specifically exempted fracing from regulation under the Safe Drinking Water Act. But does the exemption actually subject water to greater risk of pollution? Is there evidence that fracing causes water pollution? Would rescinding the exemption afford greater protection? This presentation will offer a local government perspective on the issue of fracing and groundwater quality.

Abstract

Bruce C. Bertram, LGD
Delta County

Local government concerns and responses to the oil and gas well Fracing process depends in part on the magnitude of oil and gas activity and the general knowledge of the public within its jurisdiction. There are always common concerns about the physical fracing process and the nature and chemical make up of the fluids used. The process brings with it many questions and apprehensions about its potential impact on the surrounding environment and both ground and surface waters. Local Governments play an important role in helping protect these areas by providing information and answers to questions about the process and establishing local regulations when needed. Local governments also consider the physical impacts the fracing and support equipment may have on their infra structure such as County roads, etc. Any local regulations are guided by the sometimes questionable regulatory pre-emption boundaries between them and other oil and gas regulatory agencies (state and federal). Education always plays a very important role in this process as does the enforcement of all levels of regulations. In Counties with lesser oil and gas activity or those just beginning to have activity oil and gas, the education process is a two way street. Local government officials, in some cases along with the public, are in need of such knowledge as is a similar need for the industry to know and understand valid local issues.



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Abstract

Nathan Wisler

United States Environmental Protection Agency, Region 8

In 2005, hydraulic fracturing was exempted from regulation under the Safe Drinking Water Act (SDWA), except in cases where diesel fuel is used as an additive in hydraulic fracturing fluids. On June 9, 2009 companion bills were introduced in the U.S. House and Senate to regulate oil and gas related hydraulic fracturing under SDWA. Additionally, language in the 2010 Appropriations Bill urges the United States Environmental Protection Agency (EPA) to review the risks that hydraulic fracturing may pose to drinking water supplies, using the best available science, as well as independent sources of information.

A brief history of the federal implementation of the injection well program as it relates to hydraulic fracturing will be presented. In addition, the presentation will cover how federal regulations at the EPA are developed. This could become important if legislative changes to the SDWA occur that necessitate promulgation of new federal regulations.