SLIDES: Best Management Practices for Oil and Gas Development and Comparative Water Quality Database of Regulations Relating to Shale Oil and Gas

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Public Health Law Webinar series

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Estimate U.S., Russia, and Saudi Arabia Petroleum and Natural Gas Production

- **United States**
- **Russia**
- **Saudi Arabia**

**Graph Details:**
- **Y-axis:** Estimated petroleum and natural gas production in quadrillion British thermal units.
- **X-axis:** Years from 2008 to 2013.
- **Legend:**
  - Petroleum (Dark Green)
  - Natural Gas (Light Blue)

**Legend in Graph:**
- 60 million barrels per day of oil equivalent.

**Source:** EIA
“For years, environmentalists and the gas drilling industry have been in a pitched battle over the possible health implications of hydro fracking. But to a great extent, the debate — as well as the emerging lawsuits and the various proposed regulations in numerous states — has been hampered by a shortage of science.”

Drilling for Certainty: The Latest in Fracking Health Studies. ProPublica, March 5, 2014
“Despite broad public concern, no comprehensive population-based studies of the public health effects of unconventional natural gas operations exist.”

“Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development”
Environmental Science & Technology, Feb. 24, 2014
John L. Adgate, Bernard D. Goldstein, and Lisa M. McKenzie
Where does the U.S. get imported oil?

- Saudi Arabia: 58%
- Canada: 28%
- Mexico: 11%
- Russia: 6%
- Iraq: 2%
- Venezuela: 1%
- Other: 3%
Support for the use of hydraulic fracturing by region

Data represents survey respondents who say they are familiar with the term hydraulic fracturing (42% of total base or 889 out of 2117 individuals). March 2013

Source: University of Texas at Austin Energy Poll
Who do you trust most to provide accurate, impartial information on hydraulic fracturing?

- The scientific community: 40%
- Environmental organizations: 14%
- The EPA or other federal agencies: 12%
- Oil and gas companies or associations: 11%
- Other: 8%
- Colleges and universities: 6%
- The President: 2%
- Local government: 2%
- State regulatory agencies: 2%
- Congress: 0%

All results based on weighted data.

Source: University of Texas at Austin Energy Poll
Resources

Intermountain Oil & Gas Best Management Practices project
http://www.oilandgasbmmps.org

LawAtlas Water Quality Database
http://lawatlas.org/oilandgas
PRODUCED WATER TESTING

Testing innovative technologies for treatment and reuse of flow back and produced water.
Bureau of Land Management / BMP Project

State-of-the-art mitigation measures applied to oil and natural gas drilling and production to help ensure that energy development is conducted in an environmentally responsible manner.

**Project Objectives**

- Create a free, online database documenting BMPs for responsible oil and gas development in the Intermountain West
- Provide BMPs and other resource information to a wide audience, including industry, community, government, and environmental advocates
Project Components

- Geographic Scope
  - CO, MT, NM, UT, WY
  - Beyond the Region

- Website Background Materials
  - Resource Pages
  - Law and Policy
    (Federal, state, local, tribes)

- Database and Bibliography
  - Voluntary practices
  - Required practices

- Research Services
- Workshops
Project Results

- The database contains 8,500 BMPs, from nearly 500 source documents in categories such as Wildlife, Water, Air, Health, Soils, and Vegetation.
- Resource and Law & Policy sections provide additional information, such as Hydraulic Fracturing, Economics of BMPs, Reclamation, and laws and policies governing oil and gas development in the Intermountain West.
RESOURCES

To better understand the oil and gas development process and the impacts associated with it, the following pages provide an overview of the current regulations and practices. We also provide a growing collection of resources that may aid you in your work.

THE DEVELOPMENT PROCESS

This section offers an overview of the exploration, well development, production, and site abandonment with an emphasis on best management practices (BMPs). It includes links to resources regarding legal and regulatory processes, technical descriptions, and virtual tours of well sites.

GEOGRAPHIC INFORMATION SYSTEMS

Geographic Information Systems (GIS) are used to analyze and display geospatial data and are powerful tools when examining the potential impacts of oil and gas development on local resources, such as water, vegetation, and wildlife.

This section describes the basics of GIS and provides links to sample maps, interactive web-mapping applications, downloadable GIS data, and free/open source GIS software.

AIR QUALITY

This section discusses the impacts of oil and gas development on air quality, and provides links to information on issues such as flaring, venting, methane production, and fugitive emissions. Additional information from state and federal agencies on air quality standards and monitoring is available, along with reports from non-profit organizations and regional air partnerships regarding monitoring techniques, development and technology.

WATER QUALITY

Hydraulic fracturing, storm-water runoff and pollution from pits are a few water quality issues associated with oil and gas development. This section discusses the concerns over each issue as well as fact sheets, studies, and best management practices. Additional information is provided on state water rights, pollution prevention guides, and water quality standards for areas such as the Powder River Basin, Wyoming, Montana, and Utah.
HYDRAULIC FRACTURING

Oil and gas operators have conducted hydraulic fracturing, commonly known as "fracing," for over sixty years in either vertical or slant wells (this is often referred to as "conventional drilling"). Within the past decade, the combination of horizontal drilling and hydraulic fracturing has been used with increasing frequency in each of the intermountain states (this is often referred to as "unconventional drilling"). Unconventional drilling increases the volume of natural gas that can be extracted from tight sand, coaled, and shale formations, which makes the extraction process economically feasible. The Independent Petroleum Association of America reports that over 90% of vertical and horizontal oil and gas wells nationwide now require some form of hydraulic fracturing.

HYDRAULIC FRACTURING PROCESS

After a well is drilled, it is perforated, typically with explosive charges, to fracture the tight, shale reservoir surrounding the well. The fractures are typically located thousands of feet below the water table and extend only hundreds of feet in each direction from the well. Fluid is then injected under high pressure into the well to stimulate the production of natural gas, and in some cases oil. While procedures may differ depending upon the formation, fracturing fluids are generally composed of water and chemical additives. After injecting the fracturing fluid, producers inject proppants, which is generally either sand, resin-coated sand, or ceramic, to keep the fractures open and allow gas to flow. See this video for an animation of the hydraulic fracturing process.

According to the American Petroleum Institute’s Hydraulic Fracturing Primer, hydraulic fracturing fluids generally consist of 90% water, 9.5% sand, and 0.5% chemicals. The chemicals are used to enhance fracturing fluid properties.

REGULATING FRACTING

Oil and gas development is regulated by federal, state, and local governments. For information about the regulation of oil and gas development generally, see our Law and Policy Section.

FEDERAL GOVERNMENT

Environmental Protection Agency (EPA)

The 2005 Energy Policy Act exempted the injection of fracturing fluids from the Safe Drinking Water Act’s Underground Injection Control Program. (See our Federal Water Quality Regulation Section.)
WATER QUALITY

Impacts of oil and gas development on water quality are a concern across the Intermountain West. Of particular concern are: storm water runoff from construction activities, pollution from pits, hydraulic fracturing, and use and disposal of CBM produced water. The following resources provide an introduction to the problems and best practices for each of these issues.

For a complete overview of the Clean Water Act, as it addresses these issues visit the Red Lodge Clearinghouse.

STORMWATER RUNOFF

Pollution from stormwater is an issue with all types of development from urban to rural areas. Regulation of stormwater discharges from oil and gas exploration, production, processing and treatment activities has been particularly controversial in the last few years. Resources on EPA’s web pages address both the problem and some of the solutions.

See Stormwater Permitting: A Colorado Example for an example from Douglas County, Colorado.

Stormwater Pollution Prevention Plans for Construction Activities - Information on Pollution Prevention Plans, permitting and BMPs

Construction Site Stormwater Runoff Control – Requirements, BMPs and resources for controlling stormwater runoff.

Regulation of Oil and Gas Construction Activities - A summary of the issues, legislation, regulations and litigation

STATE BY STATE

COLORADO

Piceance Basin Water Quality Repository - As large-scale energy development continues in the Piceance Basin in northwestern Colorado, there is potential for changes in surface-and groundwater resources. USGS, in cooperation with over 25 entities created a public, web-accessible common data repository combining water-quality data from various sources to establish a baseline assessment of the region’s water resources. Collaborative partners supporting the project include the energy industry, local citizens, cities and counties, state agencies, the Bureau of Land Management, private consultants, the West Divide Water Conservancy District, and the Colorado River Water Conservation District. The data will be used to develop regional monitoring strategies needed to fill identified data gaps, and minimize redundancies in current and future water-resource monitoring.

The Water Information Program - Water Rights

Colorado Oil and Gas Conservation Commission - New Rules

COGCC - Text of the rules (click on Rules)

Rocky Mountain Mineral Law Foundation Workshop - The 317B Rules

PIT POLLUTION

Pits – circulation, water storage, completion, flowback, and reserve – are dug to hold fluids and solids during well development and to dispose of waste from production. Pits may be lined or unlined, and their contents may be disposed of in many ways. Best management practices are essential for limiting pit pollution of both surface and groundwater.

Torn pit liner. Photo courtesy of Earthworks
Project Objective

- Produce and make publicly available, a searchable database of laws and regulations pertaining to shale oil and shale gas.
  - Water Quality (completed)
  - Water Quantity (June 2014)
  - Air Quality (Fall 2014)
North American shale plays
(as of May 2011)

Source: U.S. Energy Information Administration based on data from various published studies. Canada and Mexico plays from ARI.
Updated: May 9, 2011
Technology Integration Program: Objective

**Project Results (ongoing)**

- Comparative water quality database
  - [www.lawatlas.org/oilandgas](http://www.lawatlas.org/oilandgas)
  - Contains more than 1100 legal citations in five categories:
    - Permitting, Design, & Construction
    - Well Drilling
    - Well Completion
    - Production & Operation
    - Reclamation
Water Quality – LawAtlas Database

Current
- Texas – Eagle Ford, Barnett
- New York – Marcellus
- Pennsylvania – Marcellus
- Ohio – Marcellus
- West Virginia – Marcellus
- Colorado – Piceance, Niobrara
- North Dakota – Bakken
- Montana – Bakken
- New Mexico – San Juan, Permian
- Wyoming – Greater Green River, Powder River Basin
- Utah – Mancos, Uinta

Next
- Water Quantity (June 2014)
- Air Quality (September 2014)
Intermountain Oil and Gas BMP Project

Oil & Gas - Water Quality

Improved technology developments in directional drilling and hydraulic fracturing, more commonly known as "fracking," have resulted in an oil and gas production boom nationwide. In October 2013, the U.S. Energy Information Administration announced that the United States would surpass Russia and Saudi Arabia as the world's largest producer of oil and natural gas by the end of the year. The boom has resulted in oil and gas development in regions unaccustomed to the industry as well as in regions that have a century-long relationship with oil and gas extraction. Nonetheless, the rapid development of oil and gas wells has sparked concern for public health related to oil and gas development.

Because of the number of water quality statutes and regulations, the database is divided into five different stages of oil and gas activities: Permitting, Design, & Construction, Well Drilling, Well Completion, Production & Operation, and Reclamation. While this database focuses on water quality, in the coming months databases for air quality and water quantity will be added.
For more information

Browse the websites at [www.oilandgasbmmps.org](http://www.oilandgasbmmps.org) and [www.lawatlas.org/oilandgas](http://www.lawatlas.org/oilandgas)

Contact Matt Samelson  
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for questions related to the comparative database.

Contact Kathryn Mutz  
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303-492-1293  
for questions related to the BMP project.
Hydraulic Fracturing
Example Horizontal Well
Denver Post study: From 2008–2010, average of more than a spill per day, average size of 5,300 gallons
GOOD MECHANICAL INTEGRITY

CONDUCTOR PIPE

SURFACE CASING

PRODUCTION CASING

FRESH WATER AQUIFER ZONE

SHALLOW PRODUCING ZONE

TARGET PRODUCING ZONE
CEMENT CHANNELING

PRESSURE BUILDS UP

CONDUCTOR PIPE

SURFACE CASING

PRODUCTION CASING

FRESH WATER AQUIFER ZONE

SHALLOW PRODUCING ZONE

TARGET PRODUCING ZONE

CASING

CEMENT

FORMATION

swn
Southwestern Energy*
FRESH WATER AQUIFER ZONE

SHALLOW PRODUCING ZONE

TARGET PRODUCING ZONE

INSUFFICIENT CEMENT COVERAGE

CONDUCTOR PIPE

PRESSURE BUILDS UP

SURFACE CASING

PRODUCTION CASING
• Since January 1, 2013 oil and gas companies reported **495 spills**

• **210 Spills** occurred within 1,000 feet of surface water

• **136 Spills** occurred within 500 feet of surface water

• **151 Spills** occurred less than 50 feet from groundwater

• **41 Spills** occurred between 50 and 100 feet from groundwater
A worker watches oil-laden 'flowback' water spew from the bottom of an oil rig north of Windsor on Feb. 12. / V. Richard Haro/Coloradoan (Fort Collins, Colorado)