Regulatory Actions to Reduce Risks from Wastewater Injection Induced Seismicity

Aquifer Management and Underground Injection Groundwater Protection Council


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Hazards Science, Engineering and Education for Sustainability: The Risk Landscape of Earthquakes Induced by Deep Wastewater Injection
Project Background

Intermountain Oil & Gas Best Management Practices Project
http://www.oilandgasbmpps.org

LawAtlas Database
http://lawatlas.org/oilandgas
1. Catalogue current law, regulations, and orders (17 states, Federal, sample local jurisdictions)
   • Eliminate/minimize wastewater disposal IS
   • Mitigate impact of IS events on communities and environment

✓ General interest
✓ Emphasis on CCIS research topics
2. Model Regulatory Framework

- Permitting/Site Assessment
- Operations
- Monitoring
- Event Response – Adaptive Management
- Event Compensation – Bonds, Insurance

- Recognizing site specific issues
- Hazard – Risk – Deterrence
- Theories of Liability
3. Whitepaper / Website:
   • Comparison of regulations across jurisdictions
   • Federal, State, Local Authority
   • Role of scientific investigations in developing new regulations
   • Costs of enforcement and compliance
   • Voluntary industry efforts
   • Applicability of wastewater injection regulations to hydraulic fracturing
Geographic Scope
- CO, MT, NM, UT, WY
- Beyond the Region

Databases (searchable)
- BMPs
- Bibliography
- Laws and Regulations (LawAtlas)

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

Research Services
- Workshops
Intermountain Oil and Gas BMP Project

RESOURCES

To better understand the oil and gas development discussed on the following pages, we also have a growing list of resources. Links to related sites and organizations are provided for more information.

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 on state and federal agencies on air quality standards and monitoring is available, along with reports from non-profit organizations and regional air partnerships.

COALBED METHANE
Fossil fuel extraction technology is continuing to improve, and oil and gas companies are now able to economically produce energy from places that weren’t previously possible. Coalbed methane (CBM) gas production, or production of unconventional natural gas resources from coal seams, may serve to take pressure off of conventional natural gas production, but it also comes with environmental challenges. This section provides an overview of CBM technology and its challenges, particularly produced water.

PUBLIC HEALTH
Recent technological advances in directional drilling and hydraulic fracturing have increased oil and gas operations in populated areas. As of 2013, 15 million people in the United States live within a mile of a well drilled since the year 2000 (Russell Gold “Energy Boom Puts Wells in America’s Backyards”, The Wall Street Journal 2013). As with any industrial activity, upstream oil and gas operations have many hazards, which may negatively impact the health of industry workers and nearby communities.

RECLAMATION
This section provides an overview of reclamation goals, links to regulatory bodies, contact information to regulatory authorities and resource documents explaining various methods implemented in the reclamation process.

SOLID WASTE
Managing oil and gas production waste is a challenge. This section provides an overview of recent regulations and practices.
WATER QUANTITY

Water is unavoidable in every phase of oil and gas development. Varying quantities and qualities of water are both produced and used during development. On one hand, the use of large quantities of water for well stimulation, particularly high-volume hydraulic fracturing, pose legal and practical water quantity problems. On the other hand, the water produced during oil and gas development, which has traditionally been viewed as a waste product, may represent an underexploited water resource.

Browse the Water Quantity BMPs in the database.

CLASSIFICATION OF WATER

Most states draw legal distinctions between specific types of surface waters and specific types of ground waters. However, the recent trend has been towards regulating and managing surface and ground waters in conjunction.

STORMWATER RUNOFF

Watercourses: A watercourse consists essentially of a definite natural stream, flowing in a definite natural channel, and originating from a definite source of supply.

Runoff: Waters that originate from rain and melting snow and that flow freely over the surface before becoming concentrated in watercourses or before sinking into the ground are runoff. Most regulation dealing with runoff is aimed at preventing erosion and pollution caused by runoff.

GROUND WATERS

Tributary: Underneath a surface stream, there is usually an underflow or subflow. This consists of water in the sands, gravels, and other subsoil over which the surface stream flows, moving in the same direction and in intimate contact with the surface stream. The boundaries may extend laterally for

CONSERVATION ISSUES

Drought restrictions on water use are of concern, particularly in drought-stricken areas. Conservation efforts have included the banning of city water for hydraulic fracturing. Consequently, the use of domestic water use in oil and gas development is less than 0.1%.

In their 2014 report, Hydraulic Fracturing and Groundwater Protection, Ceres reported that nearly all hydraulic fractured wells drilled in the US are in regions with high or extreme drought. Approximately 73 percent are located in regions of at least moderate drought, while 27 percent are in regions of at least severe drought. The average drought duration is over 80 percent of the annual average, and groundwater inflows are lower than 20 percent of the average.

For a series of interactive maps presenting data on drought, water resources, and water use, visit the Water Resources Management website.

DISPOSAL ISSUES

There are several processes employed to dispose of waste water from oil and gas development: evaporation, land application, surface water discharge, and injection. The process used depends on the regulatory regime, water quality, and developer practice. Injection is generally favored to dispose of brackish and otherwise contaminated waters unsuitable for surface water use.

For a comprehensive analysis of current (2012) federal and state laws regulating oil and gas waste waters see the NRDC’s In Fracking’s Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater. The NRDC report highlights that currently available storage, treatment, and disposal options are inadequate to fully protect human health and the environment. But stronger safeguards at state and federal levels could better protect against the risks associated with oil and gas wastewater.

Wastewater Injection -- Class II Injection Wells

The EPA Underground Injection Control (UIC) Program is responsible for regulating the construction, operation, permitting, and closure of injection wells that place fluids underground for storage or disposal in order to protect drinking water resources. Under this program, which is often delegated to the states for implementation, there are six classes of wells: Class II wells are used for injection of oil and gas production fluids. A small number of Class II wells are used to store liquid hydrocarbons for the U.S. Strategic Petroleum Reserve. Most oil and gas related fluids are injected to enhance oil and gas development (secondary or tertiary recovery) or to dispose of waste fluids.

Based on an amendment to the Safe Drinking Water Act added by the Energy Policy Act of 2005, however, the UIC Program does not regulate injection for hydraulic fracturing. Unless disposal fluids are used in the fluids or propelling agents. See the EPA webpage on Hydraulic Fracturing and the U.S. Safe Drinking Water Act.

Induced Seismicity

One unintended consequence of wastewater injection is induced seismicity. While most earthquakes are naturally-occurring geologic phenomena, seismicity can be triggered by injection of fluids into the subsurface increasing the pore pressure in the rock that effectively reduces the natural frac. In Colorado, examples include induced seismicity from enhanced oil recovery in the Rangely Colorado oil field in the 1969-70s, brine disposal to control Colorado River salinity near Parachute, Colorado in the 1980s, and enhanced oil recovery at the Rocky Mountain Arsenal in the 1990s. More recent earthquakes have been attributed to wastewater disposal wells in Gypsum, Colorado and various other states including Oklahoma, Ohio, and Texas.

States are responding to both speculation and confirmation of wastewater injection induced seismicity with review and some revision of their regulations. For example, Colorado requires an 18- to 24-month period between the treatment of the disposal material and the injection well. See the paper Regulating Our Way to Earthquake Frag for legal and policy avenues to address the issue.
LAW & POLICY

OVERVIEW

Oil and gas development is regulated by all levels of government – Federal, State, and local – and by Indian tribes. Some statutes deal with oil and gas operations directly, while others are more generally concerned with protecting human health, air, land, wildlife, water or other resources and incidentally apply to oil and gas. After laws are passed by Congress or a state legislature, it is the task of an administrative agency such as the Bureau of Land Management, the Environmental Protection Agency, or a state agency or commission, like the Colorado Oil and Gas Conservation Commission, to issue regulations, further defining, and consistent with, the original law. Beyond their regulations (also called rules), federal or state agencies might also issue policy or guidance documents to further explain the law. The process of regulating oil and gas will be with some developing legal codes and others through their constitution, management plans, local government level, the law itself, usual the most detailed provision of law. Some just, or local use Memorandums of Understanding Agreements to regulate oil and gas.

Which laws are applicable to a particular development project? The person who owns the lands and who owns the minerals, the process can involve the government. For private or state lands and mostly state and local, although all development with the national environmental laws like the Clean Air Act and Clean Water Act. For additional information on the Clean Air Act, Clean Water Act, and other laws applicable to oil and gas development, click on one of the links at the top of this page (e.g., Federal Laws: Oil and Gas). Or go to the index page of the Oil and Gas Development section on the Red Lodge Clearinghouse website and choose a topic.

FEDERAL, INDIAN, STATE, AND LOCAL LAW

Our Federal, Indian, State, and Local Laws webpages provide brief summaries of the laws, regulations, and agency policies and guidelines of particular importance to regulation of oil and gas development. They also provide links to the codes, regulations and to the agencies in charge of regulating the industry.

For law and policy of a specific jurisdiction, click on one of the following links or on one of the links at the top of this page.

Federal: Oil and Gas | Air | Water
Indian: Laws and Codes
Colorado: State | Local
Montana: State | Local
New Mexico: State | Local
Utah: State | Local
Wyoming: State | Local
Other Laws: Water Case Law

HOW DO BEST MANAGEMENT PRACTICES FIT INTO "LAW"?

"Best management practices (BMPs) are state-of-the-art mitigation measures applied on a site-specific basis to reduce, prevent, or avoid adverse environmental or social impacts."

- Bureau of Land Management BMP website

Many people associated with oil and gas development think of BMPs as strictly voluntary practices. In the Intermountain Oil and Gas BMP Project Database, we have taken a more expansive view of BMPs, in part because what is voluntary today may be required tomorrow or may change from one jurisdiction to another. Consequently, we have included both voluntary and required practices in our database. We designate BMPs as either "Required" or "Recommended" in the database and provide our...
Comparative Law Database

- Water Quality – Lifecycle of field development
- Water Quantity – Administration, reporting, conservation, etc.
- Air Quality – Flares, engines, leak detection, storage, etc.

Current Database:

- States (17)
- Federal
  - BLM/BIA, USFS
  - EPA
- Local Jurisdictions (4)

2016 Expansion:

- Setbacks
- Induced Seismicity
- Comparative analysis factsheets
Oil & Gas - Water Quality, Water Quantity, and Air Quality

Improved technological developments in horizontal drilling and hydraulic fracturing, more commonly known as “fracking,” have resulted in an oil and gas production boom nationwide. These technological advancements are used to unlock oil and gas from shale deposits across the country, including regions unaccustomed to the industry and those that have a century-long relationship with oil and gas extraction.

Increased shale oil and shale gas development has been accompanied by increased concerns about water quality, water quantity, and air quality issues related to the development. Wastewater discharges, hydraulic fracturing fluid chemicals, improper casing and/or cementing of the bore hole, and accidental spills pose potential water quality risks. The quantity of water used to hydraulically fracture a well also varies widely depending on geologic conditions – 2 to 7 million gallons of water per well – and a well may be fracked more than once. The amount of water consumed and the timing of the water usage are of growing concern nationwide, but particularly in arid regions or in areas experiencing water shortages. Air quality concerns from the waste of methane through leaks and intentional venting and flaring of gas as well as the release of volatile organic compounds and hazardous air pollutants, like benzene and toluene, from well site operations are also prevalent.

This collection of datasets and maps includes water quality, water quantity, and air quality statutes and regulations of four federal agencies (Bureau of Land Management, Bureau of Indian Affairs, U.S. Forest Service, and the Environmental Protection Agency), 17 states (Alaska, Arkansas, California, Colorado, Illinois, Louisiana, Maine, New Mexico, New York, North Dakota, Ohio, Oklahoma, Pennsylvania, West Virginia, Wyoming), and 11 industries (Oil, Gas Production, Atherton, and others).
Explore the Law
make selections from the categories below

- At least one of these selections apply
- All of these selections apply

Well inspection requirements
Agency authority to inspect
Reuse or recycling of produced water
Collecting, holding, and disposing of produced water

- Yes
- No

Disposal of produced water
- Class II Injection Well
- Evaporation
- Centralized Waste Treatment Facility
- Publicly Owned Treatment Works
- Roadspraying
- Other

Jurisdiction(s) Found: 18

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<th>Jurisdiction</th>
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AR Regulation 178.00.1-H-1-4 (1-3) & b & e

Class II Disposal and Class II Commercial Disposal Well Permit Application Procedures

a) Definitions:

1) "Class II Disposal Well" -- means:

A permitted Class II well in which Class II fluids are injected into zones not productive of oil and gas, and brine used to produce bromine, within the field boundary established by an order of the Commission for the production of liquid hydrocarbons or brine used to produce bromine, where the well is located or will be located, for the purpose of disposal of those fluids; or
Methods:

- Legal research
  - Class II UIC
  - Oil & Gas Production
  - Other (geothermal, mining, reservoirs, groundwater withdrawal, etc.?)
- CCIS External Advisory Board
- CCIS Community Interviews
- Informal Advisors
Current:

- Qualitative Comparison of regulatory programs
  Kayleen Glasser: AR, CO, OK, OH, and TX
- Literature Review – Searchable Bibliography including States First IS Primer
- Reevaluating regulatory project workplan – identifying issues
  - Commercial v non-commercial wells
  - Data sharing
- CCIS External Advisory Board meeting - May
For more information

Browse the websites at:
www.oilandgasbmps.org and www.lawatlas.org/oilandgas

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