Oil and Gas Drilling and Production Chemicals, Waste and Environmental Impacts
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Non-Hazardous Oil and Gas Drilling and Production Waste

Wastes generated by the exploration, development, and production of crude oil and natural gas are “exempt” by Federal law from being regulated as hazardous waste.

The Solid Waste Disposal Act of 1980 prohibits EPA from regulating drilling fluids, produced water and other waste associated with the exploration, development or production of crude oil or natural gas as RCRA Subtitle C (hazardous waste.

Therefore, oil and gas wastes are referred to and regulated at the state level as “non-hazardous waste”

Environmental Protection Agency Exempt
Oil and Gas Waste Categories

Large Volume Waste

- Produced Waters
- Drilling Fluids
- Drilling Cuttings

Associated Waste

- Completion Fluids
- Production Storage Tank Sludges
- Produced Oily Sands and Solids
- Production Pit Sludges
- Washout Water and Sludge from Tank Cleaning

Quantity of Waste Streams Analyzed as Hazardous and Would be Regulated as Hazardous if Exemption Were Removed

Large Volume Low Toxicity Waste Streams
- 10 to 70%

High Toxicity Associated Waste Streams

40 to 60%

+

Just because oil and gas wastes are exempt from being regulated as hazardous waste, does not mean that the waste does not pose a hazard to workers and community members living in close proximity to the drilling, production and waste handling sites.

Water Usage and Waste Water Production during Drilling, Fracturing and Natural Gas Production

A large quantity of water is required during the drilling and fracturing process.

The use of large quantities of surface and groundwater can deplete and degrade shallow drinking water aquifers and surface water resources.

A large quantity of produced water/waste water is generated as a result of the
- -fracturing process
- -during the natural gas production phase

Shale fracturing requires
- 1.2 million gallons of water for each
  - Vertical well
- 3.5 million gallons of water for each
  - Horizontal well

Wastewater generated during the fracturing process is described as flowback water and is contaminated with the fracturing chemicals and fluids. Fracturing fluids consist of :
- surfactants
- friction reducing chemicals
- biocides
- scale inhibitors
- propping agents

The biocides consist of polynuclear aromatic and polycyclic organics that are possible and probable human carcinogens.

The flowback water is contaminated with the fracturing fluids and could be potentially contaminated with radioactive NORM which consist of the human carcinogen, Radium 226.

Each million gallons of hydraulic fracturing fluid contains @ 40,000 pounds of chemicals.

Thus a vertical well would have 48,000 pounds of chemicals in the fracturing fluid.

A horizontal well would have 140,000 pounds of chemicals.

20 to 30% of hydraulic fracturing flow back waste water remains underground. The flow back water contains large quantities of the chemicals used in the fracturing process.

Wastewater known as produced water is generated as part of the natural gas production process and is contaminated with

- volatile organic chemicals
- toxic heavy metals
- sulfur containing compounds
- NORM - Radioactive Radium 226 and 228
- salt water minerals

The volatile organic chemicals consist of Benzene a known human cancer causing agent and other organic chemicals (Toluene, Ethyl Benzene, Xylene) that are possible and probable human cancer causing agents and mutagens.

The toxic heavy metals consist of arsenic, barium, cadmium, chromium, lead, mercury, and vanadium which are known, possible and probable human cancer causing agents.

Air Emissions

During the production of natural gas (methane), condensates are also produced. The condensates consist of extremely toxic volatile organic chemicals such as benzene (known human cancer causing agent), xylene, toluene, ethyl benzene and other probable and possible cancer causing agents and sulfur based compounds (sour gas). These chemicals are released into the air from the separation process and tank storage of condensates.

Emissions into the air from produced water tanks on the production site release methane, toxic volatile organic chemicals and sulfur compounds into the air.

Natural gas is frequently vented to the air when a well is completed.

Compressors and motors on the drilling and production sites release combustion products into the air. These combustion products combine with the volatile organic chemicals in the presence of heat and sunlight to produce ground level ozone.

Elevated ozone levels result in increased respiratory impacts for community members in the area.

The released methane gas contributes to global warming.

The air emissions could have the potential to cause health impacts to workers and community members living in close proximity to drilling and production sites.

Disposal Options for fracturing wastewater and production waste water consist of:

Injection into Disposal Wells - the water is
wasted and no longer available for use

Wastewater Treatment Facilities that discharge the treated wastewater into surface water bodies - strict monitoring and compliance measures are needed to insure the protection of surface water bodies.

Emerging Technologies such as Thermal Evaporation and Brine Concentrator Technologies - air emissions from the Thermal Evaporation system is an area of concern.

Land spreading of waste water

Road spreading of waste water

Sources of Environmental Contamination

Ground water, surface water, soil, sediments and air are impacted by:

Fracturing which can create pathways that can allow migration into other non-target formations.

Leaks and spills which can occur from injection wells, flow lines, pipelines, pits, tanks, chemical storage containers, drums and trucks.

Road spreading and land spreading can introduce contaminants into the environment.

Discharges into surface water resources of waste water not meeting permit limits.

April 28, 2009 - Spring Ridge, Louisiana

Hydraulic fracturing was occurring at a well site in the Haynesville Shale and production fluids

ran off site.

40 beef cows with calves were grazing in the pasture next to the drill rig. The pasture fence was 150' from the drill rig.

19 cattle died after ingesting white, milky fluid in rainwater puddles in the pasture.

The same white milky fluid was present in puddles on the rig site.

The cattle were foaming at the mouth, billowing and had bleeding tongues prior to their deaths.

During the hydraulic fracturing process yellow-green fumes were being released into the air and deposited on the ground around the drill rig and in the pasture.

June 2009 - Cleburne, Texas - Earthquakes

Population 30,000 - 50 miles SW of Dallas

Near the heart of the Barnett Shale gas field
Since 2001 more than 200 natural gas wells drilled within the city limits of Cleburne
Johnson County - more than 1,000 gas wells
Earthquakes - 5 earthquakes in 8 days
6-2-09 2.8
6-7-09 2.6
6-8-09 2.3
6-9-09 2.8 or less
6-9-09 2.8 or less
Institute for Geophysics, University of Texas at Austin - Earthquakes probably related to gas drilling
University of Texas professor and author of "Texas Earthquakes" - earthquakes are related to drilling for petroleum and gas.
Bedford - a suburb of Dallas had 3 small earthquakes on May 16, 2009

Naturally Occurring Radioactive Material (NORM)

NORM consist primarily of Radium 226 and 228

Radium 226 has a half life of 1,622 years

Radium 226 is a bone seeker and is a known carcinogen associated with lung and bone cancer.

NORM is potentially present in flowback water and produced water from the Marcellus Shale

The NORM becomes a problem when it is concentrated, precipitated due to changes in pressure and reacts with barium sulfate to produce scale.

The scale accumulates in production piping and in surface equipment such as tank bottoms, valves and connectors, pit sludges and gas-processing equipment.
State Review of Oil and Natural Gas Environmental Regulations (STRONGER)
www.strongerinc.org/

New York Office of Natural Resources
Division of Mineral Resources

Primary Regulatory Authority of programs dealing with waste generated from oil and gas exploration and production activities

Reviews based on Guidelines for the Review of State Oil and Natural Gas Environmental Regulatory Programs

Review performed in 1994 by a multi-stakeholder review committee

1994 Review - 36 Recommendations

9 Recommendations - Administrative Criteria

3 Recommendations - Permitting

1 Recommendation - Siting

6 Recommendations - Public Participation

1 Recommendation - Contingency Planning

16 Recommendations - Technical Criteria

Recommendation

There is a need to perform a follow up review of the New York program. A specific focus of the review should be on the applicability of the regulations to protect human health and the environment with respect to the Marcellus Shale drilling and production activities and procedures. A special emphasis of the Marcellus Shale situation should be focused on water resources, water usage and wastewater disposal and reuse. The adequacy of the regulations should be evaluated to determine if they appropriately address such issues as:

-Management of flowback fluids, drilling fluids and produced water

-Waste water treatment and handling capacity to treat and dispose of waste water generated from hydraulic fracturing

-Ensure protection of ground water and surface water resources and prevent contamination of soil and water resources

-Regulations for fracturing and re-fracturing

-Buffer zone, set back and exclusion zones for well sites, compressors and tank batteries from water bodies, water wells, homes, businesses, buildings, schools, and parks

Abandoned/Orphan Sites

In 1994, New York faced a substantial abandoned sites problem with the full extent of the problem not yet known.

- Half of @ 60,000 wells drilled - lack records
- Quality of data on 30,000 wells in data base is uncertain - may drilled before 1966 - records first initiated.
- Almost 18,000 of the 30,000 wells in data base - records indicate are not plugged

There is a need to identify locations and assess environmental threats of abandoned/orphan wells and sites in the area of the Marcellus Shale.

Need for a regulatory requirement that the abandoned/orphan wells and sites in the Marcellus Shale be considered and evaluated during the drilling permit review process and during the permit application review process for commercial and centralized facilities.

NORM

Need to address the potential for NORM contamination of flowback water, produced water, tank and pit bottoms, tubular and surface equipment in the Marcellus Shale and the establishment of appropriate cleanup, treatment and disposal requirements.

Air Monitoring

Establish requirements for monitoring air emissions during drilling, fracturing, and production activities from all on site units.

Fracturing Responsibility and Awareness of Chemicals Act (FRAC Act)

In 2005 the Energy Policy Act exempted Hydraulic Fracturing from the Safe Drinking Water Act

June 9, 2009, Two Bills knows as the FRAC Act
were introduced in the US House and Senate to regulate Hydraulic Fracturing

House Bill - Introduced by Representatives from
New York and Colorado

Senate Bill - Introduced by Senators from
Pennsylvania and New York

Repeal the Hydraulic Fracturing exemption currently contained in the Safe Drinking Water Act, Underground Injection Control Program

Give EPA the authority to regulate Hydraulic Fracturing under the UIC Program within the Safe Drinking Water Act

Modify the definition of Underground Injection specifically to include Hydraulic Fracturing

Obligate oil and gas operators to disclose fracturing fluid constituents to regulatory agencies which in turn must provide the information to the public.